WHAT WE EAT
AND WHAT HAPPENS TO IT

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THE RESULTS OF THE FIRST DIRECT METHOD EVER DEVISED TO FOLLOW THE ACTUAL DIGESTION OF FOOD IN THE HUMAN STOMACH

BY

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To

MRS. M. H. HENDERSON

whose interest and encouragement have been so essential to the success of our investigations, this volume is gratefully dedicated

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PREFACE

Up to the time our investigations were undertaken at the Jefferson Medical College, practically all that was known of what really happens to what we eat when the food reaches the stomach had been learned through the use of the stomach-pump, X-ray examinations, or from experiments made on the stomachs of cats and dogs. Through the use of specially devised apparatus and the application of new methods of analysis we have been able to learn what the *human* stomach actually thinks of all the common foods which enter into the diet of man. In fact, we have been able to follow the transformations of the food that we eat, as it is actually digested by the human stomach, at every stage of digestion.

At the beginning of the work our investigations were concerned principally with the use of the Rehfuss stomach-tube, an excellent piece of apparatus, devised by Dr. Martin E. Rehfuss, of the author's staff, and which has been widely adopted by clinicians. The use of this tube has enabled us to learn many things of importance regarding

gastric digestion. As the work progressed other mechanical devices were elaborated to assist us in arriving at our conclusions. Chief among these was the intragastric conductance apparatus devised by Dr. Olaf Bergeim, of the author's staff. A delicate apparatus for recording changes in the temperature of the material undergoing digestion in the stomach was also utilized, and during a portion of our investigations we were fortunate enough to secure the collaboration of a man who possessed the unique ability to furnish samples of his stomach contents at will. The services of this "regurgitator" aided particularly in the study of the digestion of milk.

The greater part of the material in this volume first appeared in a series of articles written by the author and published in the *Ladies' Home Journal*, the last article of the series appearing in the fall of 1918. In response to the suggestion of various teachers of domestic science and to numerous laymen who believe that the results of our investigations are worthy of a permanent place, these articles have been revised and elaborated and are now offered in book form.

The author wishes to express his appreciation of the co-operation of the various members of his staff at the Jefferson Medical College in carrying out the experiments upon which this volume is founded, and to Doctor Bergeim for aid in preparing the

material for publication. He is also extremely grateful to the Curtis Publishing Company, to Mrs. M. H. Henderson, and to Dr. L. M. Halsey for providing a research fund without which the investigations would have been impossible. The kindness of the *Ladies' Home Journal* in permitting the reprinting of the articles in book form is also appreciated, as well as the spirit of unselfish co-operation shown by a large number of students at Jefferson Medical College who have sacrificed time, energy, and convenience in order that the progress of our investigations might be facilitated.

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CHAPTER I

SHOULD WE DRINK WATER WITH OUR MEALS?

THE phrases "free as water," "cheap as water," and "nothing but water to drink" are household phrases and serve to indicate the unappreciative mental attitude of the popular mind toward the vast commercial, agricultural, scientific, medical. and ethical associations which water possesses.

There is generally a good logical basis for any act of nature. Therefore, when we learn by chemical analysis that the human body contains water we at once conclude that water is essential to proper function. Even then, however, it is difficult to appreciate that the muscle which performs such large amounts of physical work is 75 per cent. water; that the brain which, in the fulfilment of its function as business manager of the body, correlates and regulates such a vast array of intricate processes and activities, is from 85 to 90 per cent. water;

that the blood, upon which the proper nourishment of every organ and tissue of the body depends, is over 90 per cent. water; that the liver cell which possesses the ability to initiate or to bring to a successful issue a large number of different processes which are vital to the proper sequence of the metabolic régime is 75 per cent. water; that the bone, the tensile strength of which may be 25,000 pounds per square inch, a tensile strength more than twice that of good timber and one and one-fourth times as great as the tensile strength of cast iron, may contain over 40 per cent. of water; that the saliva—the digestive fluid which is able to attack the complex insoluble starch molecules submitted to it in cereals, vegetables, etc., and to reduce them through a large number of definite stages until there finally emerges the soluble maltose which is later made available for purposes of nutrition—contains 99.5 per cent. of water and that its digestive efficiency is further enhanced by increasing its water content, and finally that the human body as a whole is two-thirds water, and that a 300-pound man, therefore, contains 200 pounds of this fluid. It is only after the examination of such facts as these that we fully realize how important water is to the human body.

Not only is water prominently related to the composition of the various tissues and fluids of the body, but it is also closely associated with many

extremely important activities. Thus we find water importantly related to the digestion and absorption of food; to the utilization of the digestion products; to the excretion of waste material; to the regulation of body temperature; to the elimination of poisonous substances; to respiration, etc. All these points which I have enumerated have been known and appreciated by scientists and physicians for a long time. It was, therefore, almost universally believed that the free use of water was a perfectly proper practice under all conditions except one—*water should never be taken with meals!* This was the consensus of the best scientific and medical opinion at the time our experiments were begun. How these experiments have failed to substantiate this opinion may be gleaned from the discussions which appear on the following pages.

In order to avoid the usual technical manner in which many scientists and physicians are wont to write, since they live in a technical world, it has been suggested that I write the results of our research in the form of answers to those questions on this subject that are in the public mind, and in the language and the form in which the layman asks these questions. I am glad to accept this suggestion in order that what I shall say may be easy of comprehension by every lay reader.

The first question, then, is this:

Should We Drink Water with Our Meals?

If you are normal, by all means drink all the water you wish with your meals. We have made many tests upon this subject and in every case the drinking of water, even in large quantity, at meal-time, has been shown to be a very desirable procedure. By following this rule the food is more thoroughly digested and its digestion products are more quickly and completely absorbed. Various materials which are poisonous in character are flushed out of the system and harmful bacteria do not thrive so well in the large bowel. All these things promote increased mental and physical efficiency. On the other hand, if you are a pronounced invalid and have, let us say, ulcer of the stomach or trouble with your kidneys I would suggest that you consult your physician as to the advisability of drinking much water with meals or at any other time. Some types of kidney disorder have been shown to be benefited by drinking large volumes of water, whereas other types might possibly not be so benefited. Ask your doctor. And do not ask a doctor who is as illogical as a physician friend of mine. Shortly after the publication of my first article on water-drinking he wrote me as follows: "Much interested in your experiments. I have always drunk water with my meals, with undoubted benefits to myself. However, on

general principles, I have advised my patients against the practice. So far as I am concerned, I shall no longer limit the benefit of water-drinking to the medical profession." I have received many such letters from physicians and others. One man writes: "Mark me as a water-drinker at meals—from the cradle—am now seventy-two. Everybody said I would kill myself, but instead I am enjoying excellent health. My life experience verifies your findings in all details."

Is It Well to Drink Water Just Before or After Meals?

The drinking of water immediately before a meal is a good practice. It will cause the appearance of digestive fluid in the stomach. Therefore, when the food reaches the stomach it is more rapidly digested than it would have been if no water had been taken. The drinking of a glass of hot water before breakfast is especially to be commended.

It is also good practice to drink water immediately after a meal. The stimulation thus afforded permits the stomach to handle its burden more efficiently. The absorption of the products of digestion takes place better when considerable water is present. That the human body appreciates this point is shown by the fact that concentrated solutions are not absorbed from the bowel until they are diluted. If we do not dilute them by drinking

water the body itself immediately does the diluting by passing an irrigating fluid through the walls of the bowel until the concentrated material within the bowel is made properly dilute for transportation by the blood to various parts of the body. If we drink the proper amount of water we make it unnecessary for the body to dilute the contents of the bowel. There is thus a saving of energy. Water may also be taken freely on the empty stomach midway between meals by normal men and women. However, it is preferable to do the bulk of our water-drinking at meal-time, inasmuch as the presence of a large volume of gastric fluid in the empty stomach serves no useful purpose.

Does Drinking Water with Meals Make You Fat?

That depends entirely upon the individual. Some people are made fat by drinking water, whereas others will always remain thin no matter what influences, dietary or other, are brought to bear upon them.

However, one of the fundamental principles of certain of the obesity cures is to abstain from drinking water at meal-time. A most pronounced instance of gain in weight after drinking water with meals was noted in one of our early experiments. A young man twenty-two years of age drank one quart of water with each meal for five days, and gained two pounds in weight. A further gain in weight

followed the close of the experiment. This fact, as well as many others, indicates that the benefits derived from water-drinking are not confined to the period during which the increased quantity of water is drunk. That water-drinking has a tendency to make certain persons fat is to be expected. The passage of this pure, wholesome fluid through the system flushes out various kinds of waste materials and by its stimulation causes the various organs and tissues of the body to do more efficient service. A quart of water introduced into the human system, by its presence and stimulatory power, makes for a greater mental and physical well-being.

Should We Ever Drink Ice-water? What Is the "Best" Temperature?

There is a deep-seated prejudice in the popular mind, as well as in the minds of many physicians, against the drinking of ice-water. One of the main arguments advanced is that the ice-water remains in the stomach for a considerable time, thereby chilling that organ and delaying digestion to a very pronounced degree. Fortunately, this popular belief has no basis in fact. It is astounding how rapidly the temperature within the stomach approaches that of the body after one drinks a glass of ice-water. For example, if a normal resting woman drinks a glass of ice-water (temperature

50° F.), the temperature within her stomach becomes approximately the normal temperature of the body—*i. e.*, 98.6° F.—in twenty minutes. Therefore, no matter how cold the water may be when one drinks it, the normal stomach welcomes it, and by means of a marvelously efficient temperature-regulating mechanism it quickly raises the temperature of the cold fluid until it approximates that of the stomach walls. If one drinks more than a single glass of ice-water it will, of course, take longer for the stomach to regulate the temperature, hence there will be a corresponding delay in digestion.

If one is over-fatigued, the drinking of much ice-water is unadvisable. In fact, the drinking of large quantities at such a time may be followed by serious consequences. That the fatigued stomach, in certain cases, at least, does not possess the ability to warm up ice-water as rapidly as does the resting stomach has been shown clearly in some of our tests. One might infer that the "best" temperature for drinking-water is body temperature (98.6° F.), since the body would not be obliged to take the trouble to raise or lower the temperature of such a water. However, water at 98.6° F. is not a palatable water. Moreover, such a "lukewarm" water frequently remains longer in the stomach than cold water, since cold water stimulates peristalsis.

The "best" temperature for drinking-water is about 60° F. Such a water is cold, but not ice-cold. It is cold enough to be palatable and to stimulate the motor action of the stomach, and not cold enough to produce any untoward chilling. If one is normal and is not over-fatigued a safe rule to follow is to drink the water at a temperature pleasing to oneself. Then, if moderate quantities are taken, one can be certain that within twenty minutes the temperature of the stomach is the same, no matter what the temperature of the water may have been.

There is always the possibility, in case large quantities of ice-water are taken, that it will enter the bowel very quickly and chill this organ to some extent. This would, of course, cause a delay in digestion, and indirectly affect the gall bladder, liver, and pancreas, three organs exceedingly important in the body economy.

Does the Food Swim Around in Water Drunk with Meals and Not Digest?

Until our experiments demonstrated otherwise, it was held by many physicians and scientists that the drinking of water at meal-time was harmful because it was believed that the water so taken would dilute the gastric juice, thus causing the food to swim around in the stomach undigested. If the human stomach were constructed of concrete or

copper an aquatic simile might hold. Fortunately, however, most stomachs are not so constructed. Instead, the lining of the stomach is a very delicate membrane studded with little workshops (glands) where the gastric fluid or juice is manufactured. Certain things will stimulate these glands to greater activity and cause them to make the gastric fluid more rapidly. Water is one of the most important of these. In fact, one-fifth of a glass of water, under proper conditions, will cause the outpouring of a considerable volume of a very active gastric juice from the lining of the stomach. Consequently the subsequent digestion of the food proceeds more satisfactorily than would have been the case had no water been drunk.

What Is the "Value" of a Glass of Water "the First Thing in the Morning"?

We often hear the expression "on an empty stomach." As a matter of fact, the human stomach is never empty. In the early morning, before breakfast, the normal stomach contains on the average about a fifth of a glass of fluid. This so-called residuum generally possesses at least a faint blue, green, or yellow color, due to the presence of bile and other fluids which have passed from the bowel into the stomach during the night.

If the individual who owns the stomach was the victim of a banquet or "party" the night before,

his stomach may contain nearly a glassful of this residuum filled with undigested and indigestible residues of the so-called "food" he was called upon to eat. It has been claimed that the color of this residuum is sometimes due to a micro-organism known among friends as *Cryptococcus salmoneus*, but our experiments indicate that the color is due in most cases to bile.

A glass of water, either hot or cold, serves to stimulate the formation of fresh gastric fluid as well as the motor action of the stomach. Consequently, this colored residuum which has been diluted by the water is passed quickly from the stomach into the bowel, leaving normal gastric juice in the stomach ready to digest the food which is eaten at breakfast. Moreover, the drinking of water in the early morning is a desirable practice because it serves to cleanse and refresh not only the stomach, but the mouth, esophagus, and the bowel.

It has been shown by experiment that very soon after water is drunk its presence may be demonstrated far down in the intestine. The water thus taken is, therefore, instrumental in stimulating not only the digestive processes taking place in the stomach, but also those which have their seat in the bowel. The flushing out of excess mucous material which may have collected in the gut and the removal of poisonous substances

through absorption are other kind offices which the little glass of water does for us in the early hours of the day.

If the water is hot it serves the purpose fully as well as does water of a lower temperature. In fact, some individuals derive the most satisfactory results from hot water. The use of hot water is a good practice because it raises the body temperature somewhat. The body temperature is generally slightly subnormal in the early morning, and the hot water would tend to assist in raising the temperature to the normal point.

Does a Physical Worker Require More or Less Water Than a Mental Worker?

Under like conditions of temperature, a person doing strenuous physical work should drink more water than a person who is devoted to mental pursuits. This is due to the greater loss of water from the body in the form of perspiration. If the physical worker labors in a cool environment where the loss of water through the skin is reduced to a minimum and the mental worker labors in a very hot environment, the conditions might be reversed. Very much depends upon the personal characteristics of the man or woman concerned—*i. e.*, so-called "individuality." This point was nicely illustrated in one of our experiments. Two men of like body weight were fed the same food,

drank the same amount of water, and worked together in the same room at the same temperature for a period of several days. The loss of water from the body was twice as great in one case as in the other.

We are all familiar with certain persons who perspire freely at the mere mention of physical exertion. On the other hand, others may show but slight signs of perspiration even when doing good hard work. All things being equal, however, the average physical worker needs to drink more water than the average mental worker. It is also no doubt true that the digestive apparatus of the average physical worker is more robust than is the digestive apparatus of the average mental worker. Hence, the former is not in so great need of some such stimulant as water to "speed up" his digestion.

How Much Water Should a Normal Man or Woman Drink in a Day?

The amount of water one should drink a day depends on several factors such as body weight, vocation, season of the year, character of the diet, etc. For example, a 90-pound bank clerk enjoying the shady nooks of a holiday in summer requires less water per day than a 250-pound stoker on an ocean liner. One general statement, however, can be made with certainty—the great majority of people drink far too little water. It has been

claimed that three pints of water are sufficient for the average man or woman per day. This is rather low. In order to derive the maximum benefits from our food we should drink at least three pints of water at meals alone; in other words, two glasses with each of the three meals of the day.

In order to further facilitate absorption and the general flushing of the system, with its consequent removal of poisonous substances, at least one pint additional should be drunk between meals, in the early morning, and before retiring. In other words, the water schedule of the average man or woman should call for at least two quarts of water per day, rather than three pints. In case one drinks considerable milk the water quota may be appreciably lower, since pure milk contains 87 per cent. water, and a little assistance on the part of the milkman may appreciably raise the percentage. If one eats freely of fruits and vegetables, less water is required, since these foods have a high water content. If one exercises vigorously in a warm climate the water ingestion should be considerably increased because of water lost from the body in the form of perspiration.

The amount of water which may leave the body as sweat is surprisingly large. For example, I have known a man weighing 150 pounds to lose eight pounds in three hours in the course of a fatiguing five-set championship tennis contest on a scorching

hot day. And yet tennis, by the uninitiated, is termed a "ladies'" game. The player in question therefore lost about eight pints of water from his body in three hours. Surely the three-pint schedule must be mercifully waived for such thirsty individuals as that.

What "Mineral" Qualities in Water Are Most Beneficial?

Very extravagant claims are sometimes made as to the medicinal value and curative properties of certain mineral waters which are offered commercially. The real merits of a mineral water can, however, only be demonstrated by actual tests upon man. We have recently made such tests on a thermal, alkaline, saline, mineral water. This water we found gave us very satisfactory results in derangements of the gastro-intestinal and genito-urinary tracts as well as in certain joint disorders. It is sometimes claimed that the chemical analysis of a mineral water does not always serve as a definite guide to its therapeutic action. This is particularly true of such waters as contain a large number of constituents. The effect of each individual constituent may be known, but the collective action of all of the associated constituents can only be determined by actual testing. In the case of certain mineral waters the beneficial results following their use is probably due as much to the

water as to any mineral substances present in solution.

Is It Harmful to Drink Distilled Water?

Many physicians and scientists, among them a famous Englishman, say we should not drink distilled water. They tell us that when such water reaches the stomach it irritates the delicate lining of this organ in a marked manner and may cause serious derangements, such, for example, as catarrh of the stomach. Our experiments have failed to show any harmful effect from distilled-water drinking. Such water, if properly distilled, is absolutely pure and may be safely used as a drinking-water. The water universally used for chemical purposes in laboratories of chemistry is distilled water. Since it is the most available water, it is consequently the customary beverage of most chemists. I have never known a case of catarrh of the stomach or any other abnormal state to result from the drinking of distilled water. Some individuals do not find distilled water particularly palatable. It may be rendered more palatable if it be carbonated.

How Long Does Water Remain in the Stomach?

Our experiments have shown us that water leaves the normal human stomach very quickly. In one of our tests we were able to prove that two glasses

of water left the stomach of a man in from ten to twenty minutes. Instead, therefore, of diluting the gastric fluid, the water remains only long enough to initiate the manufacture of larger quantities of the gastric fluid and then quickly passes from the scene. Ice-water, because of the fact that it stimulates the motor action of the stomach somewhat, leaves rather more quickly than do waters of a higher temperature. How do we know water leaves the stomach quickly? An outline of one of our experiments furnishes the proof. One of the young men who kindly served as subjects of our tests swallowed the Rehfuss stomach-tube, which is a tube consisting of a special metal tip to which a rubber tubing of small bore is attached. When the tip has reached the stomach we empty that organ by means of a syringe attached to the stomach-tube. Then the young man is given a measured quantity of water to drink and samples of the stomach contents are removed by means of the syringe every few minutes. The samples are acid in reaction and this acidity increases rapidly until at the end of fifteen to twenty minutes in some cases we have an acidity which corresponds to that of the pure gastric fluid. In other words, the water stimulates the formation of the fluid and then passes into the bowel, while certain little cells of the stomach wall actively manufacture pure gastric juice. By means of the X-ray, if the water is

mixed with the proper bismuth or barium compound, one can actually see the fluid as it leaves the stomach. In certain types of stomach disorder the water that is drunk remains for a considerable time in the stomach before passing into the bowel. However, if the stomach is normal the water leaves very quickly.

CHAPTER II

IS IT HARMFUL TO DRINK COFFEE, TEA, OR COCOA?

If the German nation is rightly termed a "beer-drinking nation," and the English nation a "tea-drinking nation," then, certainly in as true a sense we must term the United States of America a "coffee-drinking nation." It would be my estimate that nearly 90 per cent. of the men and women of this country are addicted to the coffee habit, and statistics show that the yearly coffee consumption of this country averages about twelve pounds of the dry coffee bean per head. The outstanding features of the average restaurant at the breakfast hour is the steaming-hot coffee and the coffee-mad throng of thirsty breakfasters. Fifty per cent. of the time the habitual milk-drinker is served with coffee because of the fact that the brain of the waiter in the early hours of the day runs in the "coffee groove."

The coffee habit has been gradually growing upon the American people, until to-day it would be very difficult to pick out a strain of pure "uncoffeeized"

American manhood. It is unquestionably true that many adults are to-day drinking coffee who have no business, from the standpoint of health, to be drinking this insidious decoction. Their digestion is bad, their nerves are shaky, and they spend much of their time in a grouch, unwittingly overlooking the fact that the little coffee bean is at the root of all their physical and mental woes.

The average American citizen becomes a Democrat because his father was a Democrat; he attends the Baptist church because his mother was a stanch Baptist; he goes to Yale because his brother was a Yale man, and finally he drinks coffee because all his elders, including his great-grandmother, are slaves to the habit. Small wonder that the coffee industry yields dividends that are attractive even to the munition-maker and Standard Oil magnate. It is a favorite pastime of some persons to upbraid this munition-maker as to the mode of becoming wealthy. How about the coffee-roaster who has for centuries been striding with hobnailed boots over the stomachs and nerves of the nations!

Commercially, coffee is a great success. The little bush accidentally discovered by the Arabian goatherd has entwined itself about the whole human race, with the result that the coffee-bush is a far mightier factor in the money-mad race for wealth than is the bean-stalk of Jack in the realm of the fairies. Just what are the comparative effects of

coffee, and of tea and cocoa, will be briefly set forth in the answers to the following popular questions that are being constantly asked by thousands of persons:

Does Coffee Really Keep People Awake?

It certainly does! Persons unaccustomed to the use of coffee will find that the drinking of a cup of the black beverage at night will interfere with their sleep. In our recent tests upon men who were not coffee-drinkers we found that three or four cups of coffee taken with breakfast seriously interfered with the sleep of these men fourteen to twenty hours later. In other words, the effect of the coffee on the nervous system continues for a comparatively long period. The fact that coffee banishes sleep is frequently made use of in a "practical" way by the hard-working student during the strenuous season immediately preceding his final examinations. The pot of black coffee is a very familiar figure at these nocturnal "grinding," "plugging," or "boning" parties. The excessive use of coffee in this way is often followed by pronounced derangement of the stomach and nervous system of the drinker for days. Should the coffee-pot prove too cumbersome, some medical students may occasionally resort to the hypodermic injection of caffeine, since they know that the "anti-sleep" effect of the coffee is due to its caffeine content. Caffeine is also believed to

cause increased rapidity of thought. If the use of caffeine be continued over a long period of time it may result in delirium, which closely resembles the delirium of alcoholism. In heart disorders caffeine administration is often accompanied by such extensive loss of sleep as to prevent its continued use.

The drinking of coffee sometimes serves a useful purpose in emergencies, such as in the case of a train-despatcher, who must be possessed of a clear, active brain in order that human lives may be properly safeguarded. Also coffee is a welcome beverage to the soldier either before or after a forced march, in order to overcome the effect of fatigue or to assist in recuperation. Likewise to the nurse on night duty it is often found a very welcome beverage. But in all such cases the purpose for which coffee is taken is to insure wakefulness, the very condition that the average man or woman seeks to avoid.

What Is the Effect of Coffee on the Nervous System?

After the coffee leaves the stomach it passes into the bowel, from which it is taken and carried by the blood to all parts of the body. The effect on the nervous system is soon seen. The pulse quickens and the hand of the coffee-drinker is no longer steady. In fact, the drinking of a large quantity of coffee by one unaccustomed to its use

may be followed by grave consequences. This point was emphasized in one of our experiments. In this instance we gave a young man at breakfast four cups of hot coffee with cream. In less than forty-five minutes his pulse had mounted to 160 and there were marked tremors of the hands, making it impossible for him to write normally or to manipulate satisfactorily the chemical apparatus with which he was working. About four hours later he felt very weak and was forced to lie down. His heart at this time was beating so rapidly it was impossible to count the pulse. The pronounced weakness continued, and he was later given a hypodermic injection of strychnine, which made him feel better. He slept very little for two nights and was very nervous for several days.

I do not wish to be understood as giving this as a picture of the direful result which *always* follows the drinking of coffee. This is an exceptional case. The man was of a nervous temperament, unaccustomed to the use of coffee, and he drank a comparatively large quantity of the beverage. However, very similar results were obtained with every man who was unaccustomed to the use of coffee. Unfortunately, there are many "temperamental" persons in this world, exclusive of "film" artists or divorcées, and it is certainly well for them to realize that the course of the temperamental coffee-drinker may prove a hazardous one. Coffee has a

stimulatory action on the kidney, and, while this has no immediate injurious effect, such may develop through the repeated stimulation of long-continued coffee-drinking. Coffee and tea may induce indigestion by their action on the nerves of the stomach.

What Is the Average Effect of One or Two Cups of Coffee at Breakfast?

The drinking of a single cup of coffee by a person unaccustomed to its use produces similar but less marked effect than where several cups are taken. The effect is decreased if the stomach contains some food. In the case of persons who have accustomed themselves to the use of moderate amounts of coffee the results are likewise less noticeable. In the case of certain less susceptible persons they might even appear negligible. The effect also varies greatly with the individual, so that, as with many questions of diet, no statement can be made which is universally applicable.

It is reasonable to assume that coffee should be used with moderation by all but very exceptional persons, and that a great many individuals had much better not use it at all. The individual will and should decide as to whether he is one with whom the chances of harm overbalance the pleasurable effects of a drugged beverage with no inherent food value. In the same way, the person who habitu-

ally takes his cup of coffee, if he be perfectly candid with himself, should be able to tell whether any over-irritability or nervous indigestion is accompanying its use.

What Is the Effect of Drinking Coffee Three Times a Day?

Simply because some person is able to drink excessive quantities of coffee daily and still maintain health is no argument that excessive coffee-drinking is the proper procedure for all of us. Let us take arsenic as an example. We all know that arsenic is a deadly poison. As small an amount as three grains (one one-hundred-and-sixtieth of an ounce) is sufficient to kill a man or woman. In spite of this fact, there are on record authentic cases of persons (so-called "arsenic-eaters") who have trained themselves, by taking gradually increasing doses of arsenic, until finally they were able to take, without experiencing any harmful effect, an amount of arsenic which would poison an ordinary individual. In the same way it is possible for the average man and woman to train themselves so as to permit the drinking of coffee three times a day without serious digestive or nervous disturbances resulting.

But is it worth our while to emulate the arsenic-eater and train our bodies to withstand the effect of such poisonous substances as caffeine and caffeol,

which are present in coffee and act on the nervous system, reacting on digestion? The choice of harmless beverages is a large one, and, should we require "stimulants," let us take them in the form which our physicians suggest. I have in mind an old lady who at eighty years of age is in robust health, notwithstanding the fact that for at least sixty years she has taken coffee three times each day. On the basis of such data one might argue that one's life-tenure and happiness are more or less directly proportional to the volume of coffee one drinks. However, the fact is that nature had so endowed this woman as to enable her to maintain robust health *in spite of the fact* that she daily drank excessive quantities of coffee.

Does Cold Coffee Produce the Same Stimulating Effect as Hot Coffee upon Entering the Stomach?

Yes! So far as the stimulating effect of the coffee in the stomach or the subsequent effect of the coffee upon the nervous system is concerned, it is immaterial whether one takes the coffee hot or cold. By means of a very sensitive temperature-registering apparatus specially devised for this purpose, we have been able to follow the changing temperature of the food in the stomach throughout the various stages of digestion, without in any way interfering with the normal stomach

digestion. We have shown in these experiments that the stomach possesses a remarkable ability to regulate the temperature of fluids passed into it.

In one of our tests, for example, we gave a young man a cup of coffee having a temperature of 50° F., and in ten minutes the temperature of his stomach contents was 97.4° F. At another time this same man was given a cup of coffee having a temperature of 122° F. (really hot coffee) and in twelve minutes the temperature of his stomach contents was 99° F.

In other words, no matter what the temperature of the coffee may be, the stomach sees to it that the temperature is raised or lowered as the case may require, and that in a very few minutes a temperature approximating that of the body is established. A drop in the stomach temperature from 98.4° F. to 66° F. was noted by means of our temperature apparatus *fifteen seconds* after a cup of cold coffee (50° F.) was passed into the stomach.

What Is the Difference in the Effect When a Nervous Person Drinks Coffee and When a Phlegmatic Person Drinks Coffee?

Coffee has a pronounced effect upon the nervous system, and for this reason, all other factors being equal, the nervous individual will be more influenced than will the phlegmatic one. The coffee will act along the same line in each case, but its action will

be more apparent if the person is naturally of a nervous temperament. It may take three cups of coffee to produce in the phlegmatic person a result similar to that which one cup will produce in the nervous person, it being taken for granted that both are unaccustomed to the use of the beverage. There are, undoubtedly, persons who do not possess nervous temperaments who will experience no ill effects from the moderate use of coffee.

How Does Morning Coffee with Sugar and Cream Affect the Stomach? With Sugar or Cream Alone? What About Black Coffee?

When you take your cup of coffee at breakfast, one thing occurs in the stomach, no matter whether the coffee was taken "straight" or with either cream or sugar or both. The thing which universally occurs is a stimulation of the glands or workshops in the lining of the stomach, causing the glands to form more gastric fluid. In other words, coffee, from this standpoint, acts very much the same as water. In fact, we may say that the stimulatory power of coffee, tea, and other watery solutions or extracts is due principally to the water they contain.

The stomach empties the partly digested breakfast into the bowel in from three hours to three hours and a half, no matter whether water, coffee, or tea was the fluid taken with the breakfast. If cocoa is taken instead of water, coffee, or tea, the

time is longer than three hours and a half, for reasons which I give later. After the coffee reaches the bowel it is absorbed and carried by the blood to all parts of the body, and influences the nervous system as already explained. Tea and coffee probably leave the stomach and are absorbed and exert their effect less rapidly and injuriously, but for a longer time, when sugar and cream are present, particularly if much of these is added.

What Effect Does Coffee Have upon Children?

It is well recognized that the young, immature, growing organism, either animal or vegetable, is more easily and quickly influenced and more readily harmed than the fully developed, mature organism. The physician recognizes this fact when he prescribes ten times as much of a certain drug for the mother as for the baby daughter to secure the same result. Our researches have shown that coffee is harmful to the adult human organism which is unaccustomed to its use. It would, therefore, unquestionably be more harmful to the child than to the man or woman. The custom of giving the young child hot water with a little tea or coffee in it (the so-called "cambric" concoctions) is one to be condemned utterly. The foundation for the coffee or tea habit is being laid at a time when the chief beverages of the boy or girl should be pure milk, and water, uncontaminated by the presence

of the harmful drugs which occur in tea and coffee.

To give a stimulant to an active, restless schoolboy is bad both logically and dietetically. What the boy needs is nourishment, and coffee not only does not give it, but, by leading to too early satisfaction of the appetite, may lead to under-nutrition. Nor can the effect in later youth be anything but undesirable. The foundation of future health is laid at this time or not at all. If the housewife is in the habit of keeping hot coffee almost constantly at hand, and using it to keep down "that tired feeling" by temporary but repeated stimulation leading to disturbances of the nervous system and nutrition, she is tempting her daughter to a practice which is likely to have a deleterious effect, through injury to her health, on the future generation.

Should the Young Mother Drink Coffee During the Nursing Period?

No! Coffee stimulates the action of the kidneys and tends to bring about a loss from the body of some of the salts so necessary to the development of the unborn child, as well as for the proper production of milk during the nursing period. The caffeine of coffee also increases the flow of milk, but the milk produced is correspondingly dilute and a later decreased secretion may be expected. Furthermore, some of the caffeine of the coffee

may pass into the mother's milk, thus reaching the child, so that the use of coffee during the nursing period is undesirable on this ground also.

What Is the Effect upon the Stomach of Saccharin Used in Place of Sugar in Tea or Coffee?

If used in small doses (up to four grains and a half or one one-hundred-and-sixth of an ounce daily) saccharin has been found to have no material influence upon the digestion processes which take place in the stomach. If the saccharin be ingested in larger quantities (from sixteen to twenty-four grains or from one-thirtieth to one-twentieth of an ounce daily) it may exert a harmful influence upon the human body. In fact, the sale of food products containing saccharin is prohibited under the Food and Drugs Act. However, exception is made of products intended for the sole use of invalids—*e. g.*, diabetics, who must abstain from sugar. Saccharin is about three hundred times as sweet as sugar and acts entirely differently in the body. The sugar is burned in the body and yields heat, whereas the saccharin is eliminated from the body unchanged.

Does Drinking Tea for Breakfast Have the Same Effect on the Stomach as the Drinking of Coffee?

So far as the stomach stimulation is concerned, tea and coffee act about the same. It is after these

beverages leave the stomach and are absorbed from the bowel that the greatest variation in their action is observed. The same type of after-effects follows tea-drinking as follow coffee-drinking—*i. e.*, rapid pulse, nervous tremors, and disturbed sleep. However, all of these after-effects are generally much less pronounced in the case of tea, and in some of our tests were but slightly in evidence. It is to be expected that coffee and tea will comport themselves similarly, since the active principle is the same in each case, but is called *caffeine* in coffee and *theine* in tea. The tea leaf contains more of this active principle than does the coffee bean. However, since a much smaller quantity of the tea is used in preparing the beverage, the tea when ready for the cup contains less of the active principle and therefore has a less pronounced effect upon the human body.

Is the Stimulatory Effect of Iced Tea Counteracted by Its Temperature?

No! Both cold tea and hot tea possess stimulatory power. After a sojourn of fifteen minutes in the stomach the tea is brought to a common temperature level (in the neighborhood of body temperature), no matter whether the beverage was freezing cold or scorching hot when it was drunk. The subsequent effect of the absorbed tea is the same in each case.

Does Lemon Added to the Tea Increase the Acidity of the Tea and Thus Cause Difficulties?

No! The lemon juice imparts a slight acidity to the tea, but this in no way causes difficulty. Tea plus lemon juice acts in all important particulars the same as tea to which no lemon juice has been added.

Does the Drinking of Tea or Coffee Retard the Digestion of the Food?

No! Our experiments indicate that the food is properly digested in the stomach in the presence of either tea or coffee. The effect of these beverages, and of coffee in particular, is shown in their action upon the nervous system, after leaving the stomach.

Does the Tannic Acid of Tea and Coffee Have Any Harmful Effect?

The content of tannic acid depends to a large extent upon the method of preparation. If modern percolation procedures are employed there is not enough tannic acid present to interfere with the digestion of food in the stomach. It has been claimed that tannic acid injures the stomach walls, but there is no evidence that this is so. In any event, the effect of the tannic acid would be less if the coffee or tea were taken with milk or cream or other foods, since a certain amount of the tannic

acid would combine with these foods and thus leave less to act upon the wall of the stomach.

Is It True That Tea and Coffee Produce a False Feeling of Stimulation When an Insufficient Amount of Food Has Been Taken?

Yes! There is sometimes a tendency to eat too little food when the meal is accompanied by the drinking of tea or coffee.

What Is the Stomach Reaction to Drinking Tea for "That Tired Feeling" at Four o'Clock P.M.?

So far as the stomach is concerned, the four-o'clock tea serves no useful purpose. The beverage enters the stomach and stimulates the stomach to manufacture a lot of digestive fluid which cannot be utilized, since there is no food present to be digested. This fluid is, therefore, wasted. The same objection applies to the drinking of water between meals.

What Is the Effect of Cocoa at Breakfast? Is It Better Than Coffee or Tea?

The action of cocoa in the stomach is strikingly different from the action of coffee or tea. In the first place, cocoa contains more fat, protein, and carbohydrate material than tea or coffee, and consequently is to be regarded more in the light of a food. It cannot be considered a food in the same

sense as meat and bread are foods, since it can be taken in only small quantity, without digestive disturbance resulting. Cocoa is also a stimulant, but a much weaker one than either tea or coffee. We have seen, for example, that coffee exerts a strong stimulatory action similar to that of water as soon as it enters the stomach. The fluid quickly leaves the stomach, and in from three hours to three hours and a half the solids and the liquids taken at the meal have been emptied into the bowel. Subsequently the absorbed coffee exerts its influence upon the nervous system. With cocoa the conditions are different. There is less stimulation in the stomach; the material passes but slowly into the bowel, thus delaying the complete emptying of the stomach, and the subsequent absorption of the cocoa is not accompanied by the untoward influence upon the nervous system. It stimulates the nervous system, but this stimulation is much less than that of coffee or tea. Cocoa has a sustaining effect which is not possessed by tea or coffee.

In one experiment in which a young man drank four cups of cocoa with his breakfast, nearly one-half of the material remained in his stomach at the end of three hours, and in another experiment the stomach was not empty in five hours. The reason cocoa leaves the stomach so slowly is probably due to its high fat content and to the presence of considerable additional fat in the cream or milk

used in its preparation, since it is a well-established fact that fats and fatty food are very loath to leave the stomach.

The cocoa may also have some specific action in delaying the evacuation of the stomach contents. It is undesirable that food shall remain unduly long in the stomach. Inasmuch as there is practically no absorption of the nutritive material from the stomach, the body derives no benefit from the food eaten until it has entered the bowel and been absorbed. Cocoa, therefore, by retarding the emptying of the stomach, deprives the body of the full benefits of the diet for a certain period, depending, to a degree, upon the quantity of cocoa ingested.

Food may be retained in the stomach for two distinctly different reasons. It may be retained because of the character of the food itself, or it may be retained because of some defect in the stomach activities. This pathological "food retention," which is an important symptom in certain stomach disorders, is an entirely different proposition from the retention of cocoa. Everything considered, if we must choose between coffee and cocoa for breakfast, let us choose the slow-moving, energizing cocoa in preference to coffee or tea, whose sole claim for our consideration rests upon its stimulating properties. Cocoa is a very satisfactory drink for children, particularly if made in dilute form and fed in small quantity.

CHAPTER III

THE TRUTH ABOUT THE MILK WE DRINK

Containing, as it does, the three fundamental elements in nutrition, protein, fat, and sugar, in addition to mineral matter, vitamines, and water, in such proportion as to render it a very acceptable article of diet, milk holds a unique place in the dietary of our country. It is the most perfect food furnished by nature, and a big glass of milk is equivalent in food value to a quarter-pound of beefsteak. In fact, an eminent foreign authority has said that a glass of milk taken over and above a man's ordinary food requirements each day is sufficient to produce in one year's time a gain of twenty-four pounds in weight. An equally eminent American authority is sponsor for the statement that "no family of five should ever buy meat until they have bought three quarts of milk."

Of rather more importance than the use of milk in the dietary of the normal adult is its use in the feeding of infants and invalids. It is a difficult task to satisfactorily rear the young of one

species upon the milk of a totally different species. The physician faces this task when he is forced to provide artificial food for his little patients. Even when "modified" according to the best of expert standards, the milk of the cow all too often falls far short of furnishing proper food for the infant. There never has been, is not, and never will be any satisfactory substitute for mother's milk. We may just as reasonably expect to find a substitute for "mother." The proper and natural place for the baby is at its mother's breast until the child shall have sufficiently developed to partake of other nourishment without danger of ill effect. When a sense of false pride or the seductive glamour of the "social whirl" is more alluring to a woman than the nestling head of her infant son or daughter she can lay no just claim to the honors and privileges of motherhood. The least a woman can do for her offspring is to see to it that it is properly and carefully nourished during the early days of its existence.

Records show that the breast-fed babe begins its little race for a healthy, happy life with much brighter prospects of ultimate success than does its bottle-fed competitor. It is, therefore, a lamentable truth that many noble, devoted mothers who would willingly sacrifice much in order that they might be permitted to nurse their offspring are utterly unable to do so for some specific reason.

In our investigations on milk we were fortunate in securing the co-operation of a man who possessed the unique ability to furnish samples of stomach contents at will, without recourse to stomach tubes or pumps—*i. e.*, by regurgitation. This unique experimental method, added to our other experimental features, including the use of the Rehfuss tube, has enabled us to arrive at very authentic conclusions regarding the practical points which surround the action of milk in the human stomach. Our conclusions are set forth in the answers to the following questions:

Is It True That Milk Curdles When It Enters the Stomach?

Yes! The fluid (gastric juice) present in the stomach contains a substance (rennin) which is classified as a ferment or enzyme and which acts upon the milk and forms curds from one of the constituents of the milk (casein). Our experiments show that this curd formation sometimes begins almost immediately after the milk reaches the stomach. The size and characteristics of the curds vary according to the source and composition of the milk and the length of time it has been in the stomach, and further variations may be produced by artificial means, such, for example, as boiling or the addition of certain chemicals.

In connection with our experiments we have made

photographs which illustrate very nicely the different stages in milk digestion. The initial junket-like mass soon gives place to definite curds of small size. The curds increase in size and are finally suspended in a clear straw-yellow fluid (whey). These larger curds coalesce, forming still larger curds, which finally digest and yield a turbid digestion mixture.

The housewife forms a milk curd when she prepares junket, by the addition of commercial "rennet" tablets to milk. But the housewife is a much more efficient curd-former than is the stomach, for she produces a pint of homogeneous junket from a pint of milk, whereas the best the stomach can do is to produce a heterogeneous collection of various sized fancifully formed individual curds. The milk cannot form a homogeneous junket-like mass in the stomach, since the stomach contents are more or less continuously in motion. However, if one drinks milk and removes samples at short intervals, it will be observed that the early samples become junket-like after standing for a time.

In the course of our tests we found one stomach in which milk would not curdle. The owner of the stomach was one of the most brilliant students in our college, and the test was made at the end of the year, immediately before the final examinations. We made several tests on this student and in every case milk left his stomach rapidly and without

curdling. He digested all other foods normally. The next fall, upon his return to college, we made another milk test upon him and found that his stomach curdled milk in a normal manner. At this time he was in fine physical condition, having had a long, pleasant vacation, whereas in the spring he was in a highly nervous state as a result of his hard study. This serves to illustrate the influence which rigid and prolonged mental application may exert upon the stomach in certain types of individuals. (See p. 100.)

Does Drinking Milk Slowly Make It Easier to Digest?

The best current medical and scientific opinion tells us to "sip" our milk—that is, drink it very slowly—whereas other opinions, which are not so good, even go so far as to say we should "chew" it. We are told that milk taken very slowly curdles in small curds in the stomach and that these small curds are more easily digested than are the large curds which are formed if we drink our milk rapidly. This line of reasoning sounds logical enough, but, unfortunately, it is wholly false. Our experiments have clearly demonstrated that curds formed in the stomach when the milk is drunk slowly are fully as large as those which follow rapid milk-drinking. This point was nicely shown by a test upon our regurgitator. One day he drank a pint of milk in ten *seconds*, and on the next day at the same hour

he drank the same volume of milk in ten *minutes*. In each instance we examined the contents of his stomach at the end of a half-hour. Not only were the curds larger when the milk was drunk slowly, but the total weight of the combined curds was greater than when the milk was passed into the stomach with maximum speed. The curds were of practically the *same consistency* in each case. We may conclude, therefore, that the rapid drinking of milk in no way interferes with its proper digestion in the stomach.

Is Boiled Milk More Difficult to Digest Than Raw Milk?

The question of the relative efficiency of boiled and raw milk as foods, particularly in infant feeding, has been actively discussed for years without arriving at an answer which was acceptable to all concerned. However, the bulk of the best recent experimental evidence is distinctly favorable to the boiled product. In our own investigations we have shown that boiled milk forms much smaller curds in the stomach than does raw milk. As a result the boiled milk digests more rapidly and the material leaves the stomach sooner than in the case of raw milk. The curds of pasteurized milk are intermediate in character between those of boiled and raw milk, but more nearly resemble those of the raw milk.

If one examines the curds formed from raw whole cow's milk in the human stomach, he will find that one hour after the milk is drunk the curds are fully as large as a man's thumb. These curds may coalesce and at a later stage in digestion enormous rubber-like curds at least three or four inches in length and one inch in diameter may be regurgitated. Under the same conditions, the curds of the boiled milk are seldom larger than small peas. Moreover, it will be noted that the raw-milk curds are always firm in character and white in color, whereas the curds of the boiled milk are always flaky and of a yellow tint. When we awake to the real significance of these observations we see at once that boiled cow's milk is intrinsically a different food from the raw product. When one examines the photographs of the different stages in the digestion of the two types of milk this difference is still further impressed.

It has been shown that milk contains growth accessory substances, or so-called "vitamines," and that these substances, which are important for growth, are not destroyed by boiling the milk. One accessory substance, called "Fat-soluble A," is present in milk fat, and a second, called "Water-soluble B," is present in the whey.

If milk be heated for one hour under a high pressure there is a change in the casein of the milk such as to render it an inadequate food. However, milk which is to be used as a food is never so

heated. Ordinarily, not over five to ten minutes' boiling suffices. The milk used in our tests was boiled five minutes.

Since I have watched the regurgitation of enormous indigestible, rubber-like curds from raw cow's milk and have seen the small, soft, flaky, easily digestible curds of the boiled cow's milk, and the tiny, fluffy curds of mother's milk, it would be a sheer waste of time for anybody to try to convince me that an all-wise Providence ever intended that our babies should be fed a calf's diet. And yet we hear protests even against the pasteurization of milk and must listen to lengthy arguments favoring the use of raw cow's milk, this "God-given food." To my mind, we will be wise if we let the young bull try to digest the india-rubber curds of raw cow's milk, while we see to it that our babies get their nourishment at their mother's breast. Raw cow's milk is the worst possible kind of milk a baby can be fed. Pasteurization makes a more desirable food, boiling still further aids in the preparation of the product, and certain definite "modifications" may possibly aid still further, but the blue ribbon must always of necessity be awarded to mother's milk.

What Happens to Skim-milk in the Stomach?

We have shown that skim-milk curdles much more rapidly than does whole milk, and that the curd of

the skim-milk is tougher than the whole-milk curd. I have seen well - formed curds regurgitated in thirty seconds after the regurgitator had drunk a pint of skim-milk, and in five minutes the curds had reached the size of a walnut. If the skim-milk be boiled the curds are smaller, the maximum size being that of a small kidney bean. It is an interesting fact that the curds of the boiled skim-milk are larger and firmer than the curds of the boiled whole milk. This indicates that the fat in the whole milk encourages fine, soft curd formation. These curds are, consequently, more quickly digested than are the firmer curds of the boiled skim-milk. It is worthy of emphasis, however, that all forms of boiled milk, whether whole or skim, leave the stomach sooner than the raw whole milk.

What Is the Difference in the Digestion of Cold and Hot Milk?

Practically no difference. I have already mentioned in my previous discussion (page 8) the great ease and rapidity with which the stomach regulates the temperature of fluids introduced into it. Such being the case, the stomach is not especially concerned with the temperature of the milk which we drink, both hot and cold milk being satisfactorily digested. There is a slight delay in the digestion of cold milk, but in a few minutes the

temperature is raised sufficiently to permit the rennin to act normally.

How Much Milk Can the Stomach Take Care of at One Time?

Just as there are all sorts, sizes, and shapes exhibited in ladies' hats, so are there all sorts, sizes, and shapes to the human stomach. To be sure, there is one stomach model which is considered more desirable than the others, but nature is very careless so far as stomachs are concerned, and is not at all averse to running in a new and fantastic model occasionally upon a poor, defenseless infant. The stomach of the normal adult is supposed to hold about a quart; but there are perfectly good stomachs that hold less, and just as many that hold more. Since this is true, each of us must learn by experience how much milk he can drink and properly digest.

It might be well to point out in this connection that the stomach is not the only point in our anatomy where milk is digested. Every normal person has present in his or her bowel, a short distance below the stomach, another milk-curdling ferment (pancreatic rennin) which possesses the same ability to curdle milk as does the rennin in the stomach. In fact, as soon as any considerable quantity of milk is drunk some of it passes into the bowel in a fluid condition. The digestion of this

portion of the milk is strictly in the hands of this second milk-curdling agent. In any event, milk is 87 per cent. water, and in a quart of milk we have to deal with only about four ounces of solids. The water is quickly absorbed from the bowel and excreted, leaving the relatively small amount of solids to undergo digestion. Milk thus serves us both as "solid food" and "drink," but is more properly considered a "solid food."

In certain milk "cures" patients are given as much as six quarts of milk per day.

Does Our Age and Weight Make a Difference in the Amount of Milk We Should Drink?

It is ordinarily customary to take the body weight into consideration when figuring a diet for any particular person. Of course, this system is perfectly good theoretically, but falls down woefully in practice when one meets a man of ninety pounds body weight who largely on account of his muscular activity eats twice as much as his wife, notwithstanding the fact that she gracefully carries around two hundred pounds. Milk is the natural food for the young, and the average child can satisfactorily take care of more milk "per pound of body weight" than can an old man, for example. But milk is a good food, no matter how we look at it, and it would be better for some of us if we drank more milk and lowered our non-aqueous fluid intake in other directions.

How Does Mother's Milk Act in the Stomach?

Very soon after mother's milk enters the stomach it curdles under the influence of the substance called rennin, which we have already mentioned. The action of the rennin is the same as in the case of cow's milk, but there is a striking difference in the curd in the two cases. The fluid surrounding the curds in mother's milk, the so-called "whey," is very turbid in appearance and is therefore in sharp contrast with the clear, straw-yellow whey of cow's milk.

Instead of the extremely large, tough white curds so familiar to us in our study of cow's milk, we here meet with very tiny, soft, fluffy curds which are yellowish in color and easily digested. No wonder the breast-fed babe enjoys life, for certainly no food will pass its lips in maturer years which for ease of digestion can compare with these minute, fluffy bits of casein. Early nurtured by such pabulum, the stomachs of America's children may safely withstand the later dietary onslaughts of over-indulgent grandmothers.

It Is Claimed That Bulgarian People Live Longer Because They Drink Considerable Sour Milk. Is It True?

The late Professor Metchnikoff was the authority for this claim. It was his belief that the poisonous substances formed by certain bacteria (putre-

factive bacteria) in the bowel of man were the cause of shortening the life of the individual. Sour milk contains another type of bacteria (lactic-acid bacteria) which antagonize these undesirable inmates of our bowels. It was Metchnikoff's claim that by drinking sour milk we could therefore prevent the formation of undue quantities of poisonous substances and thus add to the number of our days. Unfortunately, it has been demonstrated that many lactic-acid organisms prefer to live in the upper bowel, whereas the poisonous substances concerned are formed by bacteria present in the lower bowel. Another point is that the acid in the stomach destroys a large quantity of these lactic-acid organisms at the time they are introduced. The lactic-acid organism used by Metchnikoff (Bulgarian bacillus) is more resistant to acid and lives farther down in the bowel where the putrefaction occurs. It is, therefore, more useful than certain other lactic-acid organisms. However, the theory of Metchnikoff does not hold in its entirety.

Nevertheless, we owe much to Metchnikoff for calling our attention to sour milk. Its use in our dietary has much to commend it. It is readily digested and in its digestion we are not confronted by the hard, tough curds of raw cow's milk. Buttermilk, yoghurt, kephyr, koumyss, and all other sour-milk preparations are satisfactory articles of diet. The activity of the micro-organisms which produce

the poisonous products in the bowel can best be curtailed by dietary regulation. This has been shown by experimentation, and the opinion has been expressed that the beneficial effects produced by sour-milk drinking are due more to the milk as such than to the action of any bacteria which the milk contained.

Is Cream More Difficult to Digest Than Milk?

The presence of an excessive amount of fat in a milk alters its digestion in two important ways. In the first place, the fatty mixture leaves the stomach more slowly than usual; and in the second place, the character of the curd is different from the curd formed from ordinary milk.

If we drink a raw milk which contains about 4 per cent. of fat, the large, hard, rubber-like curds already described will be formed. If we add enough cream to make 20 per cent. fat these large, hard curds will not be in evidence, but in their place we will have a homogeneous, soft, curdy mass which digests without taking the form of individual curds. If we further increase the fat content to 40 per cent. there is practically no curd formation, the only curds visible being of the "pin-point" variety.

Such preparations as 20-per-cent. and 40-per-cent. cream, when taken in any considerable amount do not form a very satisfactory diet for the average stomach. They are too rich and give the partaker

a disagreeable, heavy feeling, and may even produce nausea. I have seen a man regurgitate a pint of material two and one-half hours after having drunk a pint of 40-per-cent. cream. The bulk of this regurgitated material was the original cream, a fact which emphasizes the slowness with which such rich food leaves the stomach.

Are Bread and Milk or Crackers and Milk as Easy to Digest as Milk Alone?

Yes! In fact there is some evidence that milk digests better when fed with bread.

Is Milk in Cream Soups Easy or Difficult to Digest?

The milk in cream soups, such as cream of celery, for example, is easier to digest than raw cow's milk, but less easy than boiled milk. It would be fairly comparable with pasteurized milk.

Does Salt Add to the Digestive Value of Milk?

If a small amount of salt is added to the milk it aids somewhat in the digestion of the milk. If a large amount of salt is added the milk will digest less satisfactorily.

CHAPTER IV

THE BREADS AND CEREALS WE EAT

THE cereals and breads, if properly prepared for our consumption, are all good economical foods even when purchased at the present advanced prices. Next to milk, bread is the most satisfactory individual food. Its importance in our dietary is attested by the fact that the baking industry is capitalized at over three hundred million dollars, and the sale of the bread and bakery products made annually in our country yields four hundred million dollars. However, there is a "nigger" in the breadbox, and a white nigger at that, as the answer to the following question sets forth.

Which Is the Best Kind of Bread for General Use—White Bread, Graham Bread, Whole-wheat or Bran Bread?

Of all these forms of bread the pure-white variety is the only one which is *defective as a food.* This is because the white bread is the only one of these breads which is made solely from the interior of the

wheat berry. The outer wrapping of the grain contains a mysterious chemical substance called "vitamine," which is essential for proper nutrition and whose presence is necessary if the bread is to be classed as a real food. The whole-wheat, graham, and bran breads contain this mysterious substance, whereas white bread does not. This fact is one which is of immense importance particularly to the poorer classes. If the buyers of bread will heed a warning which has a firm scientific basis, the bakers of our country will have occasion to make less white bread—this "food that does not feed"—and more of the bread which contains all that white bread contains and a considerably higher quota of mineral salts, in addition to the absolutely essential vitamine. It has been shown that seven-eighths of the phosphorus and eleven-fourteenths of the potash and lime contents of the wheat are removed in the milling of white flour. Surely nature never intended that our children should be fed this demineralized and devitamined product. Experiments have demonstrated that animals fed on white bread alone soon show unmistakable signs of improper nourishment and give evidence of nervous derangements.

Some people argue that the absence of vitamine in white bread is no reason why white bread should be replaced in the diet by whole-wheat bread, since the average diet contains sufficient vitamine from

other sources. That is true of the diet of our well-to-do classes. The innocent victims of the vitamineless white bread are the children of the poor. In many a home bread is the chief article of diet for long periods and is, therefore, the true "staff of life"; and in the majority of cases the "staff" is a "broken reed" in the shape of the white loaf. In a country which annually spends millions to aid the poorer classes, it would seem fitting that an educational propaganda be launched by which these classes could be taught that the demineralized, vitamineless white bread is nothing but a poor apology for bread, and that the housewife must use bread made from the whole of the grain if she is to insure proper nourishment for her youngsters.

It is a lamentable fact that the great mills of the country are not especially interested in the milling of the whole-wheat flour and that this indifference extends to the commercial bake-shop. The result is that much of the bread sold as whole-wheat and graham breads is but a poor imitation of a first-class product. It is a sad commentary upon the wisdom of our people when a bread so palpably defective as is white bread is sold by the billion loaves, whereas a satisfactory loaf of such an excellent food as whole-wheat bread is rarely available in our markets. In self-defense the housewife must make her own whole-wheat bread. Under war conditions the United States Food

Administration, in an effort to save wheat for our Allies, prohibited the exclusive use of highly milled wheat flour in bread. The use of such wheat substitutes as rye, barley, rice, oats, and potato was made obligatory. This action was a blessing to habitual users of white bread. The more tasty loaves resulting from the use of mixed flours will most certainly lessen the sale of highly milled flour now that the war has terminated.

Do not be misled in the evaluation of breads by the statement that there is less waste in the bowel from white bread than from any other form of bread. This is true enough, but the difference in this regard between whole-wheat bread and white bread is not great. The crux of the matter is this: the material which enters the blood of our children after they have eaten white bread is material which *does not nourish them properly*, whereas the whole-wheat product yields material which makes strong, robust, disease-resisting men and women.

Bran bread is particularly useful as a food for individuals who are troubled with constipation. As an article of diet for continual use, however, whole-wheat bread is to be preferred to the bran bread.

Is It Really Bad for One to Eat Hot Bread?

No! It has become pretty well established in the scientific and lay mind that fresh bread is "notori-

ously indigestible," and leading books on dietetics have emphasized this view. Our tests, however, failed to show this "notorious indigestibility." We fed bread direct from the oven and so hot that the steam rolled out in clouds when the loaf was cut. Then two days later we fed bread from the same "batch" to the same men, and failed to find any marked difference in the stomach digestion of the breads. We did note, however, that the hot bread generally left the stomach somewhat more slowly than the bread which was two days old. We could secure no evidence of the formation of a "doughy mass" in the stomach after the hot bread was fed. In fact, the samples of the stomach contents withdrawn at short intervals while the hot bread was in the stomach were very similar in character to those withdrawn after the "two-day" bread was eaten.

Hot bread has a very pleasing flavor, and if the bread be properly chewed there is no reason why it should not be eaten.

Which Is Better, Home-made Bread or Bakers' Bread?

Home-made bread costs less than bakers' bread and, when properly prepared, tastes better. Therefore, provided the housewife can make a good loaf of bread, there is a considerable margin of advantage in favor of the home product. After the bread

reaches the stomach one type is digested about as well as the other. If your children do not possess a very keen appetite for bakers' bread, try home-made bread and note the sudden increase in the youngsters' bread consumption. This presupposes that you are a good cook. In the hands of an unskilled bread-maker home-made bread and biscuits many times degenerate into the deadliest of culinary concoctions.

As proof that the kind of bread "mother used to make" is still appreciated, I would call your attention to the fact that it has been estimated that the baked products prepared in the homes of the United States of America last year, if sold at current market rates, would have yielded in the neighborhood of *one billion dollars.*

Does the Water Used in Bread-making Have Any Influence upon the Character of the Bread?

Yes! The mineral salts in the water affect the activity of the yeast, some increasing the action and others decreasing it. According to experiments made at Mellon Institute, if the proper mixture of mineral salts (potassium bromate, calcium chloride, and ammonium sulphate) is used the housewife may save 50 per cent. of the yeast she ordinarily employs, and at the same time have better bread. It is said that the use of these mineral salts causes the yeast to act more slowly, and this slower action

results in a saving of 2 per cent. of the sugar of the bread. This sugar would have been destroyed by the yeast (fermented) had the yeast been permitted to act at its customary rate. The Mellon Institute investigators say that if the whole of the average yearly flour production of the state of Kansas (twenty million barrels) was utilized in bread-making, the use of the mineral salts as indicated would cause a *saving of eighty million pounds of sugar a year*, and the saving in yeast represents a still larger economy than the saving of sugar.

In our tests, when the yeast was decreased and mineral salts added, the bread was found to be digested just about the same as ordinary bread.

Does the Yeast Which Is Used in Bread-making Have Any Food Value?

Yes! Yeast of itself is an excellent food. It contains within itself that occult substance called the water-soluble vitamine which is so necessary for proper nutrition. For example, if we take a white rat and feed it on milk from which the vitamine has been removed, the rat will not grow. The addition of a small amount of Fleischmann's compressed yeast (2 per cent. dried) to the diet causes the little animal to put on weight rapidly. Furthermore, beef, which is universally held in such high dietetic esteem, is likewise unsatisfactory for growth. But add a little yeast and normal growth results.

Now if yeast is good for the growth of a young rat it is good for the growth of a young child. Therefore, it would seem to be the part of wisdom to use yeast freely in baking bread which our children are to eat, in spite of the loss of sugar which results, as explained in the answer to the above question.

The food value of yeast does not rest alone upon the vitamine present. The protein of the yeast is itself a very satisfactory type of protein so far as the nutrition of mammals is concerned. It is made use of in the tissues of man to as great an extent as is the protein of milk or of meat, two of our most staple foods.

Bread made from flour to which from 5 to 20 per cent. of dried yeast (Fleischmann's) has been added forms a loaf of excellent taste. Furthermore, such a loaf is a more satisfactory article of diet than is the all-wheat loaf.

Compressed yeast has also been shown to be of use as a medicine in the treatment of certain diseases.

Is "Potato Bread" as Readily Digested as Ordinary Bread?

Yes! Owing to the scarcity of wheat, the German and Austrian governments early in the war advocated the use of potato starch in bread-making. In fact, the Austrian bakers were for a

time compelled by law to use at least 30 per cent. potato meal in making their bread. Our own government also made some baking tests, using the imported "potato flake" or Walz-Mehl. Bread containing 30 per cent. of potato meal is more moist than ordinary bread and possesses an agreeable flavor, although the loaf is rather coarse in texture and dark in appearance. This bread is as easily digested as is ordinary bread, and may be prepared at a less cost. Cooked potatoes are sometimes substituted for the prepared potato meal, with satisfactory results.

Other substitutes for wheat flour which have been investigated include bananas, chestnuts, peanuts, white beans, millet, cotton-seed flour, peas, rice, dasheen, cassava, and kaoliang. The last named is a tropical annual plant which has been recently grown with success in the Dakotas. Sugar-beet flour has also been tried abroad with success. Sweet-potato flour is also used to some extent.

Would It Be Wise to Give Only Bran Bread to Growing Children?

No! Whole-wheat bread is a better food for continued use than is bran bread. The eating of bran bread aids in overcoming a tendency to tightness of the bowels, but if eaten habitually the woody part (cellulose) of the bread might cause undue irritation of the delicate lining of the child's bowel.

Are Baking-powder Biscuits Digestible?

Yes! Our tests indicate that the stomach responds about the same to these hot biscuits as to hot bread. It would probably not be desirable to use such biscuits continually as a substitute for bread.

Is Johnny-cake a Good Food?

Experiments have shown that satisfactory growth results when young animals are fed corn and casein, the latter being the principal nutritive constituent of milk. This would indicate that johnny-cake and milk form a good food mixture for the growing child. Baking-soda should not be used in making the johnny-cake, inasmuch as it destroys the essential something called a vitamine which is present in the corn meal. In case baking-soda is employed the substitution of buttermilk for sweet milk may offset the bad effect of the baking-soda.

Which Is Easier to Digest, Steamed or Unsteamed Brown Bread?

Our tests indicate that the stomach responds rather more kindly to the unsteamed variety.

Is the Crust of Bread Less Digestible Than the Inside?

No! The crusts are satisfactorily digested when properly chewed. Part of the protein of the crust

is present in a more soluble form, and some of the starch has been partly digested to dextrin through the action of the heat in baking. The crust is fully as nutritious as the crumb or inside of the loaf.

Do the Raisins and Nuts of Certain Breads Make Them More Difficult to Digest?

There is some evidence that nut breads and raisin breads digest about as satisfactorily as ordinary breads.

How Does the Stomach Respond to Bread and Milk and Bread and Butter?

The response is very vigorous and satisfactory, particularly if the stomach in question be that of a hungry school boy or girl. Bread is digested fully as well when eaten along with milk. Both milk and butter contain the so-called "growth accessory substances," and are very useful foods for a rapidly growing youngster. Bread and honey or bread and peanut butter are also nourishing foods which are particularly attractive to the juvenile stomach.

Which Are Easier to Digest at a Morning Meal, Pancakes, Corn Muffins, or Waffles?

We have found all three to give satisfactory results in the stomach. Current dietetic opinion would probably favor the muffin. However, we have found nothing to warrant such favoritism.

The oft-maligned "hot cake" and waffle, if properly prepared, are good foods, and as easily digested as the muffin. The reason our stomachs find trouble in handling these foods is probably because we eat too large a quantity at one time or use an excessive amount of molasses or sugar with them. Of course, if our cooks insist on furnishing us with linoleum-like hot cakes and waffles we must expect the stomach to raise an objection. It might be well to emphasize in this connection that all our experiments, including those on waffles and hot cakes, were made on normal stomachs. It is to be remembered that such substances as these might be perfectly well taken care of in the normal stomach of a woman, for example, and raise a horrible furor in the pathological stomach of her husband.

What Is the Difference in the Digestibility of Wheat Cereal, Oat Cereal, and Corn Meal?

Just as there is but slight margin of choice between wheat, oat, and corn as to food value, so there is but slight difference in the action of these cereals in the stomach. The stomach handles each of them satisfactorily.

Does the Length of Cooking Add to the Digestibility of the Majority of Cereals?

Somewhat, although the difference is not so great as one might expect. The cereals are handled

pretty well by the stomach, irrespective of the length of time they are cooked.

Is Yellow Rice Better Than Polished Rice?

Yes! The polished article makes a much more attractive-looking dish, but the yellow rice is a much more satisfactory food. The continued use of a diet made up largely of polished rice will lead to a disease called beriberi, which is more or less common among rice-eating races. The outer coating of the rice kernel, which is removed in polishing the cereal, contains a chemical substance or so-called vitamine which is essential to proper nutrition. The yellow, or unpolished, rice contains this vitamine and such rice may, therefore, be eaten in large quantities for long periods of time with no sign of resulting beriberi. It is claimed that the white bean contains a substance similar to the rice vitamine. If this is true a decoction of the white bean added to a polished-rice diet should offset beriberi.

Does Molasses or Sugar with Cereals Help or Hinder Their Digestion?

If used in average amount, the molasses or sugar does not influence digestion in any marked way. However, if an excess of either molasses or sugar is added to a cereal, digestion will be delayed.

Are Twice-cooked Cereals, as Fried Mushes, as Easily Digested as When Served as Cereals?

There is a deep-seated prejudice among medical men and laymen against all forms of fried foods. However, we have been unable to demonstrate any pronounced difference in the digestion of boiled mush and fried mush. They are both good foods and are generally very attractive to children. If the digestion of fried mush causes difficulty, it is probably due to the fact that too much syrup or sugar is eaten along with it.

Which Are Better for Us, the Previously Cooked, Ready-to-serve Breakfast Foods or the Cereals, as Oatmeal, Corn Meal, etc., Cooked by the Housewife?

Whether bought "ready to eat" or prepared in the home from the raw product, the staple cereals, such as wheat, corn, oats, rye, barley, and rice, are good, economical foods. This is particularly true if the cereals are *whole-grain* preparations.

What Is the Advantage of Eating Cereals Without Sugar?

None. That is, provided we do not let our "sweet tooth" get the better of us and use more sugar than cereal. If we use an excessive quantity

of sugar the stomach digestion will be slower than would otherwise be the case.

Which Is of Greater Advantage, Eating a Breakfast Which Leaves the Stomach in a Longer or Shorter Time?

We do not get the full benefit from the food we eat until after it has been completely digested and the products of digestion carried to all parts of the body by the blood. Therefore, all other things being equal, if a food leaves the stomach slowly, we do not realize on our investment so soon as with a rapidly moving food. However, the fact that a food leaves the stomach quickly is not necessarily proof that the food has digested quickly. Different foods leave the stomach in different stages of digestion, and any given food does not necessarily leave all normal stomachs in the same time.

Is It More Difficult to Digest Fruits If They Are Followed by Cereal and Cream?

No! A half grape-fruit eaten before oatmeal and cream, for example, in no way interferes with the digestion of the cereal.

CHAPTER V

THE EGGS YOU EAT FOR BREAKFAST

Eggs are a good food, but they are not worth what the egg-man has demanded for them for a considerable time past. Under normal food conditions, such as prevailed several years ago, the food substances present in one hen's egg were worth to us only about two cents. That is, we could purchase the same amount of nutriment in the form of some other food for that amount of money. Since that time the percentage increase in the price of eggs has been much greater than in the case of other staple foods, such as milk and bread, for example. Fortunately, however, when the annual "spring drive" of the feathered egg-producers is on we are freed, for a time at least, from the fear of having to pay German war prices (ten cents each or more) for cold-storage eggs. If you wish to know how your stomach responded to the eggs you ate for breakfast read the answers to the following questions.

Do Eggs Cooked in the Same Way Digest the Same in Every Normal Stomach?

They do not! Our experiments not alone on eggs, but on other foods as well, have shown us very clearly that there are different kinds of normal stomachs. In other words, if we select ten normal persons, we may find that we have to deal with several different kinds of stomach. Two kinds with which we have very frequently come in contact are those which respond very promptly and decidedly to the entrance of food, and those which respond very slowly and indifferently to the same food. Two other kinds very frequently found are the ones which empty very quickly as compared with those which are slow to empty.

Leading books on dietetics state that two soft-boiled eggs will leave the stomach in one hour and three-quarters, but that it takes three hours for two hard-boiled eggs to make their exit. On the basis of our own experiments we can verify the statement that there are certain normal stomachs which will pass two soft-boiled eggs into the bowel in one hour and three-quarters. But—and this is the important point—there are other normal stomachs, apparently similar in every feature, which require more than three hours for the complete ejection of two soft-boiled eggs into the bowel.

We find that it generally takes the stomach longer to digest a hard-boiled egg than to digest a soft-boiled egg. We have failed absolutely, however, to verify the claim that a stomach which empties two soft-boiled eggs into the bowel in one hour and three-quarters will require three hours to evacuate two hard-boiled eggs. The stomachs we used were able to pass a couple of hard-boiled eggs into the bowel in from two hours and a quarter to three hours and a half. In other words, our tests show that it takes any given stomach about thirty minutes longer to empty two hard-boiled eggs into the bowel than to evacuate two soft-boiled eggs into the same organ.

A stomach which has a slow "evacuation time" for eggs cooked in one form will invariably empty slowly on an egg diet, no matter in what form the eggs are cooked. On the other hand, if a stomach is a "rapid emptier" it remains a "rapid emptier" and passes the eggs quickly into the bowel.

We have some evidence that a person who has a nervous temperament is generally possessed of a stomach which gives a quick and decided response to the entry of food and which empties rapidly. The slow-moving, conservative, phlegmatic individual, on the contrary, generally has a stomach which is in keeping with these personal characteristics—*i.e.*, a stomach which gives a slow and less marked response to the entrance of food and

which is in no hurry to dump its food burden into the bowel.

How Many Raw Eggs Should One Take in a Day?

If you are an invalid the number of raw eggs which you should eat per day is a question for your physician to answer. If you are not an invalid your personal feelings should be the "egg indicator." Some persons have unpleasant sensations for a time after eating two or three raw eggs, whereas there is an occasional person who is "poisoned" by eating a single egg. In like manner some individuals are made ill if they drink milk; others cannot eat certain meats; and still others are perhaps unable to handle a certain cereal or vegetable or fruit. This is called "food idiosyncrasy." Frequently a food does not "agree" with an individual, but no pronounced illness results. Still, the person would be better off if this food were eliminated from the diet.

A test has recently been developed which will permit the physician to determine whether a certain food is a proper one to feed his patient. In making this test, a tiny quantity of the food in question is inoculated into a skin abrasion. If the food is one that the patient cannot handle, this fact is indicated by a change in the appearance of the skin surrounding the abrasion.

The number of eggs that may be eaten by some

individuals without causing any inconvenience is surprisingly large. I have known convalescents to take eighteen raw eggs and three pints of milk per day in addition to "three square meals," whereas invalids have been known to consume thirty-six eggs and several quarts of milk per day.

There is also on record the case of a patient who took fifteen raw eggs daily for a year, or a total of 5,475 eggs. Another patient was given the whites of forty-eight eggs daily for many days. Such instances of egg-eating as those mentioned are, however, the exception rather than the rule. A person, either sick or well, who takes three dozen raw eggs per day in addition to a quantity of milk is in many cases at least taking more food than her or his body can use. There is consequently a waste.

In these days of the high cost of living it is desirable that we learn how little food we can eat and still derive the maximum benefit and be able to work to our maximum efficiency. If we eat a lot of food that we do not need we are burdening our whole system and especially our digestive organs, heart, and kidneys with a larger task than they can reasonably be expected to cope with successfully.

The number of eggs which should be taken in a day must, of course, be subject to a wide variation,

depending upon the characteristics of the individual in question, as well as upon the quantity of other foods which are eaten. There are those who are well informed who make the claim that the taking of six raw eggs and three pints of milk per day in addition to the regular meals will cause a person to gain weight as rapidly as will three times that amount of milk and eggs.

There is some evidence that the white of a raw egg is not used as completely in the body as is the white of a cooked egg.

If a Person Does Not Like Eggs Are They Digested Satisfactorily in the Stomach?

Among all the men who have so kindly put their stomachs at our disposal in our food tests we have found only one who did not like eggs. After undergoing one experiment on our "egg squad," he told us of his antipathy to eggs and asked to be used in the study of some other food. After explaining to him that it would be of particular scientific and practical interest to learn what a stomach which "had no use" for an egg would do to it, this man very kindly consented to sacrifice his personal feelings and remain on the "egg squad" in order that science might profit. We found that the stomach of this man took care of eggs just as satisfactorily as did the stomachs of the men who liked eggs. This would indicate that

so-called "food idiosyncrasy" is not necessarily associated with the stomach.

In What Form Should Eggs Be Cooked in Order to Be Most Digestible?

There are over one hundred ways in which eggs may be cooked. That may sound like an overstatement! However, there are two classes of people who will vouch for its accuracy. One is the professional chef and the other is the person who, for reasons of health, has been forced to eliminate meat from his or her diet for long periods of time. Milk, eggs, and vegetables are the staple foods for persons who cannot eat meat, and if one lives for a couple of years or longer upon such fare, the housewife, in order to rule out monotony of diet, needs to exercise all her ingenuity to devise new and attractive methods by which the egg may be made gastronomically appealing.

In our tests we studied the digestion of eggs cooked in the following ways: Soft-boiled, soft-cooked; hard-boiled; fried; fried on both sides, using excess fat; poached; scrambled; scrambled, using excess fat; shirred; pickled; deviled; plain omelet; Spanish omelet; bacon and eggs; and scrambled eggs with "frizzled beef."

Our studies show that a soft-boiled or soft-cooked egg is digested rather more rapidly and

satisfactorily in the stomach than is an egg prepared in any other way. The margin in favor of the soft egg is, nevertheless, slight, since the stomach gives a hearty welcome to all kinds and conditions of eggs, even the much-maligned cold-storage and "frozen" egg being made to feel at home.

Why Is a Fried Egg Harder to Digest Than a Boiled Egg?

There is a very deep-seated prejudice against fried foods, and the fried egg is the recipient of many hard "knocks." However, the human stomachs which we have studied made good use of fried eggs. In fact, these stomachs treated the fried egg much the same as they treated the boiled egg. No matter how hard the eggs were fried nor how "greasy" they were, these stomachs greeted them heartily and digested them satisfactorily.

Of course, when an egg is fried for a long time at a high heat, a portion of the outside of the egg white becomes tough. Some of this hardened egg white may pass into the bowel, where the final steps in its digestion will take place more slowly than would be the case with the white of a boiled egg. It is also true that some stomachs may find difficulty in properly digesting fried eggs if they are "smothered" in grease. When all the facts have been reviewed, however, we can find no

basis for the belief that the normal human stomach assumes an arrogant and uncompromising attitude toward the fried egg.

Are the Milk and Eggs in "Egg and Milk" Digested Any Differently Than When Each Is Fed Separately?

Yes! In the chapter on "Milk" (page 37) I described the formation of large tough curds when raw cow's milk entered the human stomach. The situation is vastly different, however, when a raw egg escorts the milk to the stomach. When the milk is thoroughly mixed with the egg and taken into the stomach the formation of the large curds no longer takes place. For this reason the milk in "egg and milk" digests rather better in the stomach than does the raw cow's milk without the egg. Egg and milk is a favorite food for invalids and convalescents, and one reason such satisfactory results follow its use is due to the fact that the formation of large curds is prevented by the presence of the egg. So far as the digestion of the egg is concerned, this takes place in much the same way as when eaten without milk.

Are Cold-storage Eggs Satisfactorily Digested in the Stomach?

Yes! Our tests show that the stomach shows no favoritism so far as eggs are concerned. The

old and infirm city storage egg receives just as kind a reception as does its fresh country cousin. The eggs obtained by us from a Philadelphia storage concern were said by the dealer to have been in storage for eight months, which is the extreme limit permitted by the laws of Pennsylvania. It is a well-known fact, however, that a cold-storage egg guards the secret of its age as jealously as some men and many women, and for this reason we may be reasonably sure that the eggs used in our tests were at least eight months old.

When one examines into the egg question from an unbiased angle, there is really no ground for the belief that cold-storage eggs are difficult to digest. For example, if a chemist takes two fresh eggs and analyzes one in the fresh state and analyzes the other after it has been in cold storage for a period of eight months he will fail to find any marked differences in the two eggs. In other words, the food value of an egg is not markedly lowered by such storage.

Chinese preserved eggs, or "pidan," which are duck eggs preserved by a special process, leave the normal human stomach more slowly than any other eggs we have examined. The slow digestion of these eggs may be due to the fact that they have undergone considerable change in the course of preservation.

How Do "Frozen Eggs" Act in the Stomach?

Many unsavory and indelicate statements have been made in the public press concerning the "frozen eggs" which have been offered for sale in our markets. Bacteriologists have examined these products and in some instances have found so many bacteria present that they were unable to count them. Pure-food officials have frowned upon the sale of these eggs. This fact may be taken as indicating that some "frozen egg" preparations are not in good standing among men who are supposed to be able to tell a good egg from a bad one.

In spite of all these compromising things which have been said about "frozen eggs," it is apparent that the "frigid" product has one friend left. This friend is the human stomach. Our tests show that the stomach does not discriminate against frozen eggs. Sponge cake, for example, made with the aid of frozen eggs was treated just as kindly in the stomach as was sponge cake similarly prepared with the aid of fresh eggs.

In fairness to frozen egg preparations it should be said that some of them constitute very satisfactory food. The frozen eggs we used, for example, were not as bad as those I have described. However, no matter how many bacteria were present in the original "frozen eggs," many of them would have been killed in the baking of the cake. And even if they were not dead, but were very much alive

and ready and anxious to give battle to the human body, that fact would not excite the stomach to any appreciable extent. The human stomach is able to protect itself against the majority of bacterial invaders. Not so with the bowel, however. Certain harmful bacteria which are sometimes present in our milk, water, and vegetables, for example, may cause fatal damage if they successfully run the gantlet of the stomach's "blockade."

Why Is an Omelet Easy to Digest? Is a Spanish Omelet More Difficult to Digest Than a Plain Omelet?

In general, all other things being equal, the greater the surface of the food substance which is in contact with the gastric juice the more rapidly will the food substance be digested in the stomach. A properly prepared omelet is light, fluffy, and porous in character. Therefore, when it reaches the stomach this omelet offers a much greater surface for the action of the gastric juice than is offered by scrambled eggs, for example. Consequently, the omelet is particularly easy of digestion. The Spanish omelet is digested about as well as a plain omelet.

Is It Preferable to Eat Eggs Which Digest Rapidly?

If an egg digests slowly the body is slow to derive the benefit from the food substances in the egg, whereas if the egg is digested rapidly the body is

quick to derive the benefit. This must of necessity be so, since the energy and stimulus which the body gets from the food cannot be made available until the products of the digestion of the food have been borne from the bowel by the blood to all parts of the body. It is remarkable how fast certain of the foods we eat get into the blood. Sugar may enter the blood and be available in a very few minutes after it is eaten, whereas other foods, such as eggs, meats, etc., take a much longer time.

How Many Cooked Eggs Should Satisfy a Reasonable Individual?

That depends entirely upon who the "reasonable" individual may be. If he happens to be a husky "lumberjack" in a Canadian forest he will many times fail to be satisfied with fewer than eight eggs at a sitting, to say nothing of the beans, bacon, bread, black coffee, and other "grub" he uses as a background. On the other hand, an underpaid and underfed sweat-shop "operator" with an invalid mother to support would many times be "satisfied" with a single egg a day if she could afford such luxury. It depends!

What Is the Difference in the Digestion of a Soft-cooked and a Soft-boiled Egg?

Practically no difference. The soft-cooked eggs were prepared by dropping the eggs into boiling

water and allowing them to remain in the water for seven minutes without further heating. The soft-boiled eggs were prepared by dropping the eggs into boiling water and boiling for three minutes. Eggs prepared by these two methods were equally well digested in the stomach.

Eggs Are So Often Used in Place of Meat. Is the Digestion About the Same?

Meats contain a class of important substances called "extractives" which are not present in eggs. The extractives have the power to stimulate or "speed up" the workshops (glands) in the lining of the stomach which manufacture the gastric juice. For this reason we generally obtain a stronger stomach response when we eat meats than when we eat eggs. In spite of this more favorable response of the stomach to the entrance of a juicy steak, compared with the response evoked by the entry of a couple of soft-boiled eggs, for example, the consensus of opinion seems to be that meats are not prepared for entry into the bowel as quickly as are eggs.

Is Fried Bread or So-called "French Toast" Digested Satisfactorily in the Stomach?

This French toast was prepared by soaking bread in raw egg and then frying the egg-and-bread combination. Bread prepared in this way was

found to act about the same in the stomach as ordinary bread which had not been treated with egg.

Does the Stomach Respond the Same to the Egg White as to the Yolk?

No! In some stomachs, at least, the yolk receives a more hearty welcome than does the white. In preferring the yolk the stomach shows a wise discrimination, for it is the yolk which contains the major portion of the food value of the egg. The average hen's egg, exclusive of the shell, weighs about an ounce and a half, the ounce being egg white and the half-ounce egg yolk. But the ounce of white is principally water and yields only about one-thirteenth of an ounce of food substances, whereas the half-ounce of yolk yields about one-fourth of an ounce of food substances.

Egg analyses show that the solid matter of the yolk differs from the solid matter of the white principally in containing more fat, phosphorus, and fuel. The white of the egg contains a mere trace of fat, whereas one-third of the yolk is made up of fatty substances, some of them phosphorized and all of them furnishing fuel for the body and yielding heat. The yolk of the egg also contains larger amounts of those mineral-builders of bone and blood (calcium and iron) than are present in the egg white. In view of the great value of the yolk of the egg,

it would be well for all chickens to embrace prohibition principles, since experiments have shown that the use of alcohol by birds will cause them to lay eggs having abnormally small yolks.

Does the Adding of Mustard or Vinegar to Deviled Eggs Make Them Harder or Easier to Digest?

The custom of using mustard or vinegar has very little to commend it. They may serve to disguise the flavor of an unpalatable dish, but if the food is properly prepared one does not need to use a "mustard mask." Such substances will "speed up" the manufacture of gastric juice, but this is unnecessary in the presence of staple articles of diet, since they will themselves see to it that enough gastric juice is manufactured to secure satisfactory digestion. In any given stomach deviled eggs with mustard and vinegar are digested about the same as hard-boiled eggs without mustard and vinegar.

Are Ducks' Eggs and Turkeys' Eggs as Digestible as Hens' Eggs?

Eggs of the duck and turkey act about the same in the stomach as do eggs of the hen. This is a logical finding, since all these varieties of eggs are very similar in composition, the main difference being that the ducks' and the turkeys' eggs are slightly larger than the average hens' egg. But

a little egg substance more or less, either raw or cooked, makes no particular difference to the normal stomach. In fact, if we could find a stomach of proper proportions, even the egg of the ostrich would probably be digested satisfactorily.

It is claimed by a French chemist that eggs contain arsenic and that the egg of the duck contains more than the egg of any other species of fowl. This claim should not disturb us, however, since the arsenic, if present, is there in a mere trace and can do us no harm. In order to get enough "duck egg arsenic" to poison yourself, if you are an average man or woman, it would be necessary to eat at one sitting the annual output of a good-sized duck-farm.

Is a Soft-shelled Egg Any Harder to Digest Than an Egg Made According to Established Standards?

A change in the daily routine adds variety and is heartily welcomed by most of us. Thus our feathered friends become weary of laying the same old-fashioned eggs day after day and year after year. When this monotony becomes unbearable the ducks, turkeys, and chickens try their hand at the manufacture of "something different." The result may be a soft-shelled egg, a double-yolked egg, an egg within an egg, two eggs hitched together end to end, two entire eggs in a single shell or some other unusual product. We were unable to obtain

any of these "freak" eggs for our tests, but there is no reason to suppose that they digest any differently from eggs made according to recognized standards.

Is a White Egg More Nutritious Than a Brown One?

No! It is not the shell that determines the character of the egg any more than it is the "clothes that make the man." The lay mind of some localities (*e.g.*, New York City) prefers the white egg, whereas in other localities (*e.g.*, Boston) the brown egg is preferred. Therefore, many first-class hotels and restaurants cater to these popular preferences.

CHAPTER VI

THE MEATS WE EAT AND WHAT THE STOMACH DOES WITH THEM

Statistics show that the United States of America is first among the nations of the world in the production, killing, packing, and marketing of meats. And to show that they appreciate home industry the people of our country eat more meat per capita than is consumed by the people of any other nation. In fact, we pay between two and three billion dollars per year for the meats we eat. That the money is not entirely well spent is indicated by the fact that a given amount of nutritive material costs more in the form of meat than in the form of milk, bread, cereals, or eggs. In spite of this fact, the meats are excellent foods and should be included in reasonable amount in the diet of all normal adults.

How Does the Digestion of Meat Compare with the Digestion of Milk, Bread, and Eggs?

The entrance of any food substance into the normal stomach causes the formation of gastric juice

which attacks the food substances and begins to digest them. However, if you examine the gastric juice formed when you eat meat and compare it with the juice which is formed when you eat other foods, you will find that the meat has caused the formation of a juice which contains more hydrochloric (muriatic) acid. The explanation is simple. Meats contain a class of substances called "extractives," which are not present in other common foods. They are called "extractives" because they may be "extracted" from the meat by water, for example. Due principally to the presence of these "extractives," which bear such interesting names as xanthine, hypoxanthine, and creatine, the eating of meat causes the production in the stomach of extra-large quantities of gastric juice, which has a pronounced digestive action. A scientist would speak of the extractives as "strong gastric (stomach) stimulants." We may say, then, that the stomach responds more quickly and in a more decisive manner to meats than to any other class of foods.

It is also true that meats as a class remain in the stomach longer than other foods, except fats, and for this reason stomach digestion is probably more important in connection with meats than with any other kind of food. This is due to the fact that the lean meats are composed, in large part, of albuminous substances (proteins) which are normally

digested in the stomach and the digestion products further transformed in the bowel. On the other hand, starches, in addition to changes in the stomach, are acted on in the mouth, and both starches and fats are digested in the bowel.

We have made the interesting observation that raw meat from which the bulk of the extractives have been removed is sometimes almost as strong a "gastric stimulant" as is the original raw meat. This may be due to the fact that the extractives are such powerful stimulants that the presence of a small amount is sufficient to produce a strong action upon the glands in the stomach, or it may mean that the substances (digestion products) formed from the meat through the action of the gastric juice have themselves "stimulated" the stomach glands. However, be that as it may, it has been found by experiment that the body does not ultimately derive the full benefit from meat which has lost its extractives. In other words, there is more loss in the bowel from such meat than from unextracted meat.

Does the Quantity of Meat One Eats Influence Its Digestion in the Stomach?

Yes! In the great majority of our tests we fed one hundred grams (a little over three ounces) of meat. In other tests, planned to aid in answering such questions as the above, we fed two hundred and

fifty grams (over half a pound). In every instance the stomach responded more slowly to the large quantity of meat. This slower response was evident in the character of the gastric juice which was formed in the stomach, as well as by the length of time it took the meat to leave the stomach. Tests on three different kinds of meat showed that the three-ounce portions of meat left the stomach in about three hours and a half, while it took the half-pound portions about five hours and a quarter to make their exit. In other words, the stomach acted more slowly on the larger quantity of meat, but it did not take the stomach two and a half times as long to do its duty by two and a half times as much meat. It is a fortunate thing that the stomach readily adapts itself to large loads, else certain persons might find themselves in difficulties.

Many People Cannot Eat Veal. Why Is It? Is It True That Veal Under Six Weeks Is Poisonous?

Veal is a perfectly satisfactory food, and in our experience acts much the same in the stomach as do beef and lamb. If any normal person cannot take care of veal properly it is due in most instances to idiosyncrasy. The deep-seated popular prejudice in this country against veal may have some slight influence in causing certain persons to conclude that they experience difficulty in digesting this meat.

In Europe, and especially in Germany, veal holds a high place among meats, and is considered preferable in many respects to beef. In fact, it is even fed to invalids, a practice which would probably meet with almost unanimous condemnation from the medical profession of America. The manner of cooking the veal may also be an influencing factor. The use of very young veal, or so-called "bob veal," has met with special condemnation in this country because it has been believed that such veal was poisonous.

We made several ineffectual attempts to purchase "bob veal" in the open market, but were in each instance informed that the sale of "bob veal" is illegal. We were, therefore, forced to buy a calf and do our own slaughtering. When we compared the response of the stomach to this "bob veal" with the stomach response to the ordinary market veal we were unable to note any outstanding differences. In fact, both types of veal were satisfactorily taken care of in the stomach and treated much the same as beef and lamb. There was in no case any sign of veal poisoning.

In Germany before the war, calves from three to five days of age were frequently slaughtered for food. While the meat of such young animals is a perfectly satisfactory food, the practice of killing immature calves is bad from the economic standpoint.

In comparative tests on "bob veal" twenty-four hours after slaughtering and forty-eight hours after slaughtering, we found that the stomach responded in a more pronounced way to the forty-eight-hour veal. In other comparative tests we found that "bob veal" left the stomach in about the same time as roast turkey and stewed chicken. This similarity in the action of "bob veal" and stewed chicken may be a further incentive to use "bob veal" in chicken potpies, a practice which is not entirely novel.

Do We Derive as Much Benefit from a Cheap Tough Meat as from an Expensive Tender Meat?

Yes! The tough meat may be less pleasing to the taste and certainly causes more work for the muscles of the jaw, but if the two types of meat contain the same amount of nutritive materials the body will ultimately derive as much benefit from the tough as from the tender meat. In our work on tough meat we fed the toughest steaks (chuck and shank) we could find after diligent search, and compared their digestion with the digestion of the tenderest of tenderloin and sirloin steaks. In one case we were surprised to find that it took three and one half hours for the tender steak to leave the stomach, whereas its "tough associate" left in two hours. It would seem that this stomach, at least, did not desire to prolong its intercourse with the

tough visitor, but got rid of him quickly by introducing him to the bowel. A human characteristic in a way! Just why a tough steak leaves a certain stomach more quickly than a tender one is not clear. It may be due to the fact that more care is given to the mastication of a tough meat and that it, therefore, reaches the stomach in the form of smaller pieces.

One often meets apparently well-balanced, logically thinking men to whom the deliciously tender and juicy steaks cooked by skilled chefs do not appeal. Appetites such as these, many times, stand as memorials to the tough steaks which they ate as country boys and which were fried in the family skillet until they assumed the consistency of poor sole leather. The steaks often had their origin in the superannuated family cow or in the ox which was served as food when he became too decrepit to "do his bit" in any other capacity.

There are those who say that tough meats have a more pleasing flavor than the tenderer meats, due to their higher content of the substances called "extractives." I am rather skeptical upon this point. However, the practical thing to bear in mind in these days of inflated food prices is that the cheaper cuts of meat, if properly cooked, are just as digestible and nutritious as the more expensive cuts. Our observation, noted elsewhere, that three dollars' worth of canvasback duck (about three ounces) left

the stomach in the same time as ten cents' worth of tripe (also about three ounces) lends further emphasis to the fact that the digestibility or food value of a meat is not determined by its financial rating.

Is Pork Really Difficult to Digest? Is Pork with Apple Sauce Digested Any More Rapidly? How About Ham and Bacon?

The popular belief that pork digests slowly was borne out by our experiments. No matter in what form the pork was fed, whether as roast pork, pork chops, bacon, or ham (boiled, baked, or fried), the meat was, in the majority of cases, a slow-moving food. Of all these pork preparations the roast pork left the stomach soonest (three hours and a quarter). Pork chops, ham, and bacon were retained in the stomach a half-hour longer before they were permitted to enter the bowel. It is a safe surmise that the average stomach hates to see a piece of pork coming its way, since it means a busy session for all the forces at the stomach's command. Pork is, nevertheless, a highly nutritious food and cannot be said to be in any sense indigestible. In fact, it is only a little less rapidly digested than certain other common meats. Even bacon, which is very high in fat, is satisfactorily digested in amounts somewhat larger than usually taken. Notwithstanding the fact that in the average stomach the digestion of pork is a slow process,

we found some "fast" stomachs which could empty pork into the bowel in less than two hours and a half. In fact, a man whose stomach did not empty in five hours when he drank four cups of cocoa at breakfast was able to pass "soused" pigs' feet (mostly jelly) into the bowel in two hours and a quarter. In another instance, after eating roast pork, a man's stomach emptied in two hours. These are striking exceptions, however.

The taking of apple sauce along with pork had no particular influence upon the digestion of this meat in the stomach. There is apparently no basis for the claim which is sometimes made that the acid of the apple sauce aids in the digestion of the pork. However, since apple sauce itself is a good food and inasmuch as it has no harmful action, but may perhaps give added relish to the pork, there is no reason why it should not be eaten. For the same reason cranberries may be eaten with roast turkey, although our experiments fail to show that they aid the stomach in its digestion of the turkey.

Is It True That Chicken Is Much More Easily Digested Than Beef, Veal, or Lamb?

No! One of the things which surprised those of us who were in close touch with our tests was the fact that chicken, either stewed, roasted, or fried, on the average remained in the stomach fully as long as beef, veal, or lamb. These three meats

passed into the bowel in about three hours, the beef requiring a trifle less than three hours and the veal and lamb a little more, but the average time for chicken, in all forms except broiled, was nearly three hours and a half. It seems, therefore, that chicken, either stewed, roasted, or fried, causes the stomach more worry than any of the ordinary meats (except pork) which constitute the bulk of man's meat-supply. On the other hand, our tests indicate that *broiled* chicken leaves the stomach more rapidly than any one of the meats just mentioned. In our experiments we made rather more tests upon roasted meats than upon meats cooked in other ways. If we compare the various meats on the basis of the roast meats, we find that roast veal left the stomach first (in about two hours and three quarters), with roast beef and roast lamb following in the order named, and that roast pork and roast chicken were about tied for fourth place at three hours and a quarter. There is thus a difference of only half an hour in the stomach digestion of the "fast" and "slow" roast meats.

Is the Breast of Chicken More Digestible Than the Dark Meat?

There is a deep-seated opinion that the white meat of the chicken is more digestible than the dark. So far as the stomach is concerned, our experiments fail to verify this claim. The stomach poured out

about the same kind of a digestive secretion (gastric juice) upon the white meat as upon the dark meat and retained each about the same length of time. If we examine into the actual composition of these two kinds of meat we fail to find any basis for expecting the stomach to show favoritism in the matter. The dark meat contains a little more fat and somewhat less protein (the substances of the meat fibers), but the differences are too small to influence the digestive decision of the stomach. In view of these facts, why buy the breast of chicken when you can purchase the dark meat for about one-half the money?

There is a tendency to look upon the meat of the turkey as very similar to that of the chicken. The comparison holds fairly well for the light meat of the two fowl, but when we come to the dark meat we find that the turkey flesh contains over twice as much fat as the chicken flesh of the same color. The meat of the guinea-hen is very similar in chemical composition to the white meat of the chicken, whereas the flesh of the duck is very high in fat and more closely approaches the dark meat of the turkey in this respect.

Is "Cold-storage" Chicken More Difficult to Digest Than Freshly Killed Chicken?

Our tests indicate that the stomach is not very successful in differentiating between cold-storage

chicken and the fresh article. The only apparent difference noted was a tendency for certain stomachs to empty cold-storage chicken into the bowel a little more slowly than fresh chicken. The difference in any event was slight. Some of our cold-storage fowls had been in storage for five months and others for ten months, which period is the extreme limit allowed by the laws of the state of Pennsylvania. The storage chickens were sometimes broiled, while at other times they were fed fried, roasted, or stewed, and in every case the men who ate the chicken pronounced it very palatable. The stomach evidently concurred in this verdict.

We hear much criticism of cold-storage products, but if the chicken is killed and stored by modern methods for the lawful periods of time, there is no reason why it should not be considered proper food for anybody to eat. It is rather difficult for the average person to tell whether they are eating cold-storage chicken or chicken fresh from the farm. However, the experienced cook who actually handles the fowls can readily tell the difference.

Which Makes Most Digestible Meat, Stewing, Roasting, Broiling, or Frying?

We tested this question thoroughly in the case of chicken. Taking into consideration all experiments upon both fresh and cold-storage fowls,

we found that the broiled chicken was more digestible in the stomach than chicken cooked in any other way. The average stomach passed the broiled fowl into the bowel in less than two hours and three quarters, whereas roasted chicken took second place and the stewed and fried chickens brought up the rear.

Does Any Given Meat, Such, for Example, as Roast Beef, Pork, or Veal, Digest at the Same Rate in Every Normal Stomach?

No! In the chapter on "Eggs" (page 67) I called attention to the fact that our work has shown very clearly that all normal human stomachs are not alike. I there pointed out that some stomachs gave a pronounced and rapid response to eggs, whereas other stomachs responded more slowly and indifferently. I also pointed out that some normal stomachs emptied much sooner than others when eggs cooked in the same way were introduced into them. In our study of meats we have again found the above rules to hold. The men to whom we fed our meats were, for the most part, an entirely different group of men from those used in the egg tests. Nevertheless, we found that some of the normal stomachs emptied very quickly, whereas other stomachs emptied very slowly, no matter what kind of meat was eaten. For example, one of our "fast" stomachs emptied roast

veal into the bowel in two hours, whereas it took one of our "slow" stomachs twice as long—*i.e.*, four hours—to do the same job. Furthermore, the stomach which worked rapidly with veal worked in the same rapid manner with five other meats, and the slow stomach worked in the same slow, plodding fashion with three other kinds of meats which were introduced into it. Another "fast" stomach emptied roast pork into the bowel in two hours, notwithstanding the fact mentioned elsewhere that the pork products, as a class, are "slow-moving" meats.

Are "Light" Meats Preferable to "Red" Meats?

There are a great many people who claim that "red" meat (beef) should not be eaten by persons suffering with gout, rheumatism, or nephritis (kidney disease). To invalids of this character they would feed the "light" meats, such as chicken, veal, and lamb. The opponents of "red" meats base their "embargo" upon the supposition that such meats contain more "extractives," or "uric acid-producing substances," which are believed to aggravate the conditions named. As a matter of fact, accurate chemical analyses of the various meats fails to show any material difference in the extractives which are present in the meats of different hue. It is, nevertheless, apparently well established that certain "gouty" persons cannot

eat red meat without discomfort, whereas they suffer no ill effects when they eat the light meats.

It is a significant fact that the Eskimo eats three times as much meat as the average American, and yet is never troubled with gout.

What Are "Scrapple" and Tripe? How Do They Act in the Stomach?

The principal "habitat" of scrapple is apparently in and about Philadelphia. Still, it is the exception if you can find out from a Philadelphia butcher who sells the scrapple what it really contains. In order to secure authentic information on this subject I wrote a letter of inquiry to three leading purveyors of this preparation. From these sources I learned that scrapple is a mixture of pork and cereals, well seasoned with herbs. The head and jowls of the pig are used and in some instances the heart and liver, as well as the trimmings from hams, loins, and shoulders, are included. The cereals used in scrapple are generally a mixture of wheat flour and buckwheat flour, or corn meal and wheat middlings, or corn meal and buckwheat flour.

Scrapple has good food value and in our tests was found to be quite palatable. It left the stomach rather slowly, as do all pork products, and the stomach did not give the scrapple as hearty a reception as it accorded such foods as steaks, chops, etc.

Some scrapple tastes much like pork sausage. The sausage, however, is more rapidly digested in the stomach. It leaves this organ in about three hours, whereas scrapple requires nearly four.

At least two well-educated people have spoken in my hearing of tripe as a *fish*. However, tripe is not a fish, but is made from the stomach of the cow or steer. It is a perfectly good food and acts in the stomach much the same as more expensive meats. We found, for example, that three dollars' worth of roast canvasback duck (about three ounces) left the stomach in about the same time as ten cents' worth of fried tripe (also about three ounces).

Does Worry, Anxiety, or Anger Influence Stomach Digestion?

Yes! It has been shown by X-ray studies on cats, dogs, rabbits, and guinea-pigs that any sign of anger, distress, or anxiety causes a complete cessation of the movements of the stomach. That the emotions also affect the movements of the stomach of man was nicely shown in one of our tests. The subject of the test was a first-year medical student. The time of the test was the day of the examination in organic chemistry. The incompatibility existing between organic chemistry and the mind of the average freshman medical student is well known. We therefore argued that if it were possible to stop the movements of a freshman's

stomach an examination in organic chemistry ought to do it. At nine o'clock in the forenoon the student was given about three ounces of fried chicken, and it was *six hours and a quarter before the stomach passed the last of the chicken into the intestine.* One week later, when the organic-chemistry examination was a thing of the past, and the student, for this reason, was in a happier mental state, he was again given a similar portion of fried chicken. This time his stomach emptied in four hours and a quarter. This was the normal "evacuation time" for this particular stomach and this particular meat, but the anxiety of the student over the organic-chemistry examination evidently brought about at least a partial stoppage of the stomach movements at the time of the first test, and this in turn caused some of the chicken to remain in the stomach two hours overtime. For further discussion of the psychic phase of digestion see Chapter XIII (page 215).

Is There More Waste from the Bowel When a Meat Leaves the Stomach Rapidly?

It is claimed that all kinds and cuts of meat are very thoroughly digested by normal adults, no matter how the meat may be cooked. In other words, practically the same percentage of the nutritive materials of the meat is used by the body without regard to the source of the meat or the manner of

its preparation. In short, a given amount of food substances in the form of the tenderest of planked tenderloin steaks yields us no greater quota of food value than is available to us in the form of the belly of the hog. Granting that this claim is true, it does not by any means signify that every person can eat indiscriminately of all sorts of meats prepared by all sorts of cooks in all sorts of ways and suffer no ill effects. The conclusions referred to were reached after examining the amount of waste from the bowel when men were fed different meats. In other words, only the first step (the meat) and the last step (the waste) were taken into account. How about the intermediate stages in the process? The fact that two men journey from Philadelphia to New York and spend the same amount of money on the way does not necessarily mean that each man had the same experiences or consumed the same amount of time en route.

In other words, different meats remain in the stomach different lengths of time and enter the bowel in different stages of digestion. It would be folly to try to convince a stomach, which empties broiled chicken into the bowel in one hour and three quarters, but which requires four and a quarter hours to rid itself of venison, that broiled chicken and venison are the same from its (the stomach's) standpoint. And the stomach has "inside information" and ought to know.

The question of idiosyncrasy also enters in to complicate the problem; idiosyncrasy to meat and to cooking as well. Some perfectly normal persons cannot eat pork, others cannot eat veal, while still others cannot eat fried foods of any kind. In the last analysis one must find out for oneself what meats one cannot eat, and learn to have no association with these particular meats, no matter how attractive they may be.

Is "Hash" Digestible?

That depends on what the hash contains. The characteristic "boarding-house hash" which the average boarder stigmatizes as made from old rubber boots and discarded trunk straps we did not investigate. We have tested only one kind of hash—chicken hash. This hash we found to be very digestible and left the stomach rapidly. Beef hash should also leave the stomach rapidly, since the bulk of the hash is generally potatoes, and this vegetable leaves the stomach rather quickly as a general rule.

Are Canned Meats as Satisfactorily Digested as Fresh Meats?

One of the severest tests to which canned meats were ever subjected took place during the Spanish-American War. At that time there was much outcry against the so-called "embalmed beef" which was being furnished our troops. The United

States government ordered an inquiry into the nutritive value of these meats. In the course of their inquiry the meat was fed to normal men and it was found that the men derived about as much benefit from it as from a similar quantity of fresh meat. This fact was somewhat surprising in view of the fact that the "embalmed meat" was unappetizing in appearance and unpalatable. In fact, one of the subjects said the presence of the meat in his mouth caused a feeling of nausea, and he was literally forced to "poke the meat down his throat."

The conditions surrounding the canning industry are much better to-day than ever before. Meats that are properly canned to-day are probably perfectly good foods and are not open to the slurs which were cast upon the "embalmed meats" during the days of the Spanish-American War. In our own investigations the labor involved in the study of a large number of meats cooked in many different ways rendered it impossible for us to give canned meats any consideration. A study of the digestibility of canned meats as compared with the same meats in the fresh condition is now being made at Harvard Medical School.

Which Digests Most Quickly, Roast Beef Well Done, Medium, or Rare?

There is not very much difference in the rapidity of digestion of roast beef cooked in the three

ways. In our tests eight stomachs out of ten emptied in three hours or less when rate roast beef was fed; three out of five when the roast was medium, and two out of six when the meat was well done. The "consensus of opinion" of the stomachs is therefore slightly against the well-done beef, but the margin of difference is slight.

Is "Wild Game" Such as Venison and "Canvas-back" Duck Digested Properly in the Stomach?

"Wild game" as represented by venison, canvas-back duck, and rabbit leave the stomach rather slowly. The average "evacuation time" for such game is around four hours, as contrasted with a little less than three hours for steaks and roast beef and a little more than three hours for chicken. That is, meats of this kind remain in the stomach about as long as pork, which is the slowest moving of our ordinary meats. It may be that those animals and fowl which are raised for food purposes furnish us meats which, as a class, are rather more digestible than are the meats which are obtained from their "wild" relatives.

Are Commercial Meat Extracts Good Foods?

No! In the preparation of the extracts the bulk of the food substances of the meat are removed. The finished extract consists principally of mineral

salts, extractives, a little fat, and small amounts of sugar (glucose) and protein (from the muscle fibers). While it is true that these extracts have no food value to speak of, it is also true that they serve a very useful purpose when properly used. They have the property, for example, of hastening and strengthening the activity of the little glands in the stomach which manufacture gastric juice. Furthermore, they act in a similar manner upon other digestive glands in the body. Therefore, the physician makes use of these extracts sometines when he wishes to use a "stimulant." The hot "beef tea" made from these extracts is a palatable drink which is relished by the normal person as well as by the invalid.

What Happens to Us if We "Bolt" a Breakfast?

Much has been written and spoken regarding the desirability of thorough and complete mastication. In fact, some go so far as to say that we should "fletcherize" our food—that is, chew the food until it is swallowed mechanically. We have tested out this question on only two men, but we found that these men derived about as much benefit from a meat that was "bolted" in big chunks as they derived from the same meat when "fletcherized." However, what holds for meats may not necessarily hold for other foods. In fact, one would rather expect to find that a vegetable food which con-

tained considerable cellulose (woody material)—*e.g.*, string beans—was rather more digestible when thoroughly masticated. This is a point we hope to study at some future time.

Is Horse Meat Good for Food Purposes?

Yes! The flesh of the horse is somewhat similar in composition to that of the cow and sheep. It has been used for years in certain continental countries, and under the stress of war the butcher shops of England openly offered it for sale. And now America is falling in line and even the conservative Quakers of Pennsylvania have recently passed a law legalizing the sale not only of horse meat, but *mule meat* as well. Horse meat is very apt to be tough, because of the fact that the horse is generally used for eating purposes only when it is good for nothing else. When that time arrives the horse is pretty certain to be well along in years. There are many animals whose names are never mentioned in food discussions, the flesh of which would make "good eating." Among these may be mentioned the muskrat, guinea-pig, whale, seal, and manatee (sea-cow), while Doctor Wiley suggests, as a war measure, that we eat our pet dogs and pussy-cats. It is also reported that a lion cub two months of age, and fresh from an African jungle, was recently served at a private dinner in New York City. This must be considered as a "head-

liner" for that select list which includes among its most notable features such epicurean novelties as nightingales' tongues, roast ostrich, and baked crocrodile. Certainly such family friends as ham and eggs, scrapple, and tripe find no "fellow feeling" in such gastronomic company as this.

Should Mustard Be Used on Meat?

The use of mustard has nothing to commend it in connection with any food, and least of all with meats. The job which the mustard assumes is to stimulate or "speed up" the manufacture of gastric juice. This is a wasted effort in the presence of meats, because meats contain "extractives" which, for this particular purpose, are in a class considerably above mustard. The use of mustard was tested by us in connection with lamb chops, roast lamb, and the frankfurter, or so-called "hot dog." The addition of mustard to the frankfurter or lamb caused the stomach to empty more slowly than usual. When the frankfurters were eaten without mustard the stomach emptied in about two hours and a half or less, whereas this time was prolonged to at least three hours and a half when mustard was added. In the case of lamb the "evacuation time" was delayed from a quarter to three-quarters of an hour by the mustard. The mustard had the most pronounced effect in the stomachs of men who did not habitually use it.

Are Sandwiches Digestible Foods?

Yes! However, the tale of the sandwich is much longer than that. In our work we tested ham sandwiches which were purchased for five cents each at a local restaurant. Two of these sandwiches weighed about four ounces, but only about two-thirds of an ounce was ham. A trace of butter could be noted on the inner surface of the sandwich, provided the observer knew for what he was looking. Two of these sandwiches left the stomach in about the same time as three ounces of roast beef. In general it may be said that one does not make a wise investment when one purchases the average sandwich. However, the purchase of the five-cent sandwiches I have mentioned is a much better investment, from the standpoint of food value, than is the purchase of the thirty-cent ham and tongue sandwiches and the fifteen-cent coffee sold at certain so-called "higher class" restaurants. A luncheon consisting of bread and butter and milk may be had (in one's own office, for example) which is far more nutritious and costs less. In these days of "high cost of living" and small-sized loaves the wise man who desires his "money's worth" need not expect to get it if he pays thirty cents for two small pieces of bread separated by a few transparent meat shavings. If the "sandwich-eater" appreciated the fact that for seventy-

five cents one can purchase enough cold tongue, bread, and butter to make ten or a dozen "thirty-cent sandwiches" of the size constructed from the average loaf of graham, whole wheat, or rye bread, there would be fewer such sandwiches sold. Statistics of this character show one close relationship which exists between excessive profits and the high cost of living.

Is Corned Beef More Difficult to Digest Than Fresh Beef?

The stomachs of our subjects responded about the same to the corned meat as to fresh roast beef, the main difference being that the preserved beef generally remained a little longer in the stomach.

CHAPTER VII

THE VEGETABLES THAT THE STOMACH LIKES AND DISLIKES

The articles of diet we class as "vegetables" constitute a rather mixed group of foods. They are all of plant origin, but the term "vegetable" is not always applied to the same part of the plant. For example, we eat the *leaf* of the cabbage and lettuce plants, the *fruit* of the tomato and cucumber plants, the *seed* of the bean and pea plants, the *bulb* of the onion plant, the *tuber* of the potato plant, the *root* of the carrot plant, the *stalk* of the celery plant, the *stem* and *leaf* of the spinach plant, and for good measure we throw in a few cereals such as rice and sweet corn, and label the whole mass "vegetables." However, over a half billion dollars' worth of vegetables, exclusive of all cereals, are grown in the United States yearly. Evidence for and against the use of these vegetables is given below.

Do Raw Vegetables, Such as Raw Carrots and Cabbage, Give the Stomach More Work Than When Cooked?

No! In fact, in the majority of cases the raw carrots, cabbage, tomatoes, etc., leave the stomach rather sooner than do the cooked vegetables. This observation might be taken as an indorsement of the "raw-food cult." But there are two sides to the raw-food question. If we eat our food raw we run a risk of also eating "raw bacteria," and most of us prefer to eat our bacteria cooked if we must eat them at all. It is important in this connection to remember the fact that the stomach contains a good "bacteria-killer" in the gastric juice, but it does not serve to kill all sorts of "bugs" under all sorts of conditions. Raw vegetables and fruits contain so-called "antiscorbutic substances" which will prevent the eater of the raw food from developing the disease called scurvy (scorbutus). If the food be cooked, the content of these "anti-scurvy" substances is said to be much lessened. Recent experiments indicate that scurvy may follow pronounced constipation and the formation of bacterial poisons in the lower bowel. There is, however, a difference of opinion on this point.

A strong argument for cooked food is that the flavor is in most instances much improved, and a strong argument against cooked food is the loss in

nutritive substances which many forms of cooking entail. Certain of our foods most of us prefer to eat cooked. These include meats, fish, starchy vegetables (potatoes, etc.), peas, beans, lentils, parsnips, and beets. Others, such as oysters, clams, carrots, cabbage, tomatoes, apples, celery, and onions, may be eaten either raw or cooked. Experiments have shown that putrefaction (decomposition of protein material by bacteria with the formation of injurious products) in the bowel is much decreased when rabbits are fed raw carrots. However, that is no proof that a carrot diet would do the same service for the human bowel, since the average rabbit is rather more fond of raw carrots than are some of the rest of us. In any event, if we are to eat raw foods we should see to it that they are properly cleaned and preferably of known origin. The serving of a raw vegetable with a "sand dressing" not only reflects discredit upon the housewife, but is bad for the teeth as well.

Is It True That Spinach Is One of the Best Vegetables for the Blood? Why?

None of the green vegetables, such as spinach, cabbage, lettuce, celery, asparagus, etc., is eaten because it is rich in food substances (protein, fat, starch) or because it yields much energy or heat (calories) to the body when the body makes use of it. As a matter of fact, these green vegetables

are of value in the diet, primarily because they contain an indigestible substance (cellulose or woody material) which distends the bowel and hastens the movement of the bowel contents (*i. e.*, stimulates peristalsis). In other words, the indigestible portion of these green vegetables acts as "ballast" or "roughage" and plays a very important part in the proper "regulation" of the bowel. The value of these vegetables is further enhanced because of their content of mineral salts and vitamine, in this case the vitamine being of particular value in preventing scurvy.

The relationship of spinach to the blood lies in the fact that spinach contains a relatively large quantity of iron among its mineral constituents. In fact, when we compare fresh vegetables on the basis of the iron content we find that spinach contains more of this element than any other known vegetable. Furthermore, every cell in the human body contains iron, and one of the most important constituents of the blood (the coloring matter—hemoglobin) also contains iron. When the supply of iron in the body is decreased sufficiently the amount of coloring matter in the blood also decreases and anemia results. This is particularly apt to occur in the case of growing children if their diet is not properly chosen. After a pronounced anemic condition has become established the eating of spinach or any other food will not cure the condi-

tion. It is a case for the doctor. In order to postpone the anemia as long as possible let us eat, and cause others to eat, foods which are rich in iron. In addition to spinach and other green vegetables the "iron foods" include meat, egg yolk, beans, peas, lentils, olives, and fruits in general. The green vegetables have another "blood bond" in that their green coloring matter (chlorophyl) is somewhat similar, from the chemical standpoint, to the red coloring matter (hemoglobin) of the blood.

Our experiments show that green vegetables, such as spinach, lettuce, and cabbage, are very little changed during their stay in the stomach. In the case of spinach, for example, the pieces are broken up into smaller pieces through the movement of the stomach and the action of the gastric juice, but when the stomach considers its "job" completed the spinach is just as green as it was when eaten, and the real digestion of the vegetable is "in the hands" of the bowel.

Is the Potato Entitled to "First Place" Among Vegetables?

If we consider all-round "vegetable efficiency" we can probably do no better than to pin the "blue ribbon" on the potato. We make this statement with the understanding that the competition is open only to vegetables, thus making rice, barley,

and other cereals "ineligible." The potato is important first because of its high starch content. Starch is such an important article of food that it has been estimated by Doctor Wiley that the mouths of America eat twenty-five billion pounds (over twelve million tons) every year, an average of two hundred and fifty pounds of starch for each of us. The mineral matter of the potato is also another strong point in its favor. In fact, one of the chief assets of vegetables in general is their content of mineral salts. The potato is particularly rich in potassium salts and iron, whereas, in common with most other vegetables, the content of sodium chloride (ordinary table salt) is low. Those of us who have attempted to eat unsalted potato need no further proof of the accuracy of this last statement. Ordinary salt is the only form of mineral matter it is necessary to add to the average mixed diet, since the rest of the much-needed minerals are present in proper amount if we eat the right quantity of the right kind of food. Sodium chloride we must have in order that it may play its important part among other things in the formation of the gastric juice of the stomach and in the maintenance of the normal composition of the blood. Every adult needs at least a third of an ounce of salt daily, but the average mixed diet contains nearly this much if properly seasoned. No matter how much mineral matter we eat in the form of

vegetables, there is practically no danger of altering the normal composition of the important fluids or tissues of the body by such means, since any excess mineral matter is eliminated. On the other hand, there is always the danger of eating too little mineral matter.

The paring of potatoes in the careless manner so often prevalent causes a loss of about 20 per cent. of the food substance of the vegetable. Consequently, in war-torn Germany the paring of potatoes was prohibited. This is a wise edict, for the potato lends itself readily to cooking "with the jackets on." Moreover, the skin itself has food value, and if the potato be baked the skin possesses an appetizing flavor. The practice of adding milk and butter to "mashed" potatoes is a good one, because the potato is low in protein and fat. The "fuel value" (calories) of the potato is also raised by frying, since the fried product (chips) may contain over 30 per cent. of fat, whereas the original potato contained only one-tenth of 1 per cent. We have records showing that entire families, including children, have lived for long periods on nothing but potatoes. This is bad dietary practice, nevertheless, although it serves to impress upon us the importance of the potato as a food. The fact that "potato flour" may be used in bread-making has already been referred to in an earlier chapter on "Breads and Cereals" (page 52).

How About the Sweet-potato?

When we compare the ordinary potato with the sweet-potato the reaction of the stomach is rather more satisfactory in the case of the white potato. From the standpoint of food value the sweet-potato stands first in everything except protein. In other words, it contains more fat, starch, mineral matter, and calories (heat units) than does its white rival. The flavor and composition of both types of potatoes are influenced considerably by the character of the soil in which they are grown. This is shown by the fact that potatoes grown in certain soils are "mealy" when boiled, whereas those reared in soil of a different character may be less mealy, although possessing just as great food value. Ordinarily the white potato contains at least twice as much iron as does the sweet. Sweet-potato flour has been used with good results.

Does the Stomach React the Same Toward the Natural Brown (Unpolished) Rice as Toward the Ordinary White (Polished) Rice?

The main difference in the reaction of the stomach to these two kinds of rice is that the white (polished) rice leaves the stomach somewhat more slowly than the natural brown (unpolished) rice. However, the "rice evidence" does not close with the stomach's testimony. We must also listen to the cry of men

and animals whose nervous systems have been harmed through the excessive and long-continued ingestion of the white rice, with the ultimate production of "polyneuritis," or "beriberi." In order to make a rice which shall be pleasing to the eye, the external brownish covering of the grain is removed by a polishing process. We thus get a rice which appeals to our esthetic sense, but the nervous system "pays the toll." In addition to mineral matter, the brown exterior of the rice grain contains within itself a minute amount of a substance which is essential to proper nutrition. This has been called an "accessory food substance," or vitamine. The natural brown rice is a satisfactory food because vitamine and mineral matter are present as nature intended they should be; the white rice is an unsatisfactory food because of the absence of these important substances. Fortunately, the diet of the average individual contains a sufficient amount of "accessory food substances" from other sources to insure normal nutrition even though white rice be eaten.

What Are Chayotes? Do They Resemble Any of Our Common Vegetables in Taste or Digestibility?

The chayote is a vegetable which grows on a climbing vine and which is native only to Mexico and Central America. It has, however, been introduced into other countries, the United States

being the latest to undertake its cultivation, this being begun in the South. This tropical vegetable is a botanical relative of our own sedate summer squash. The relationship is not particularly apparent, however, either externally or internally, since the chayote is shaped like a pear and its flesh is much firmer in texture than is the flesh of its cousin the squash. When the chayote is eaten, however, it cannot possibly longer conceal its family connections, since its flavor is very similar to that of summer squash. Our tests show that chayote leaves the stomach more rapidly than squash. However, squash stimulates the stomach more than chayote, and thus causes the formation of a "stronger" digestive fluid.

Are Steamed Vegetables More Digestible Than Boiled Vegetables?

There is no marked difference in the digestion of vegetables cooked in these two ways. Nevertheless, it is preferable that the vegetables we eat shall be prepared for us by steaming rather than by boiling. In the boiling process there are losses of mineral salts and other food constituents, and for this reason the boiled vegetable is not as satisfactory a food as is the steamed vegetable. The extent of the cooking losses are very considerable in the case of certain vegetables. Thus potatoes lose about 18 per cent. of their mineral matter

and from 8 to 16 per cent. of their protein when boiled; carrots lose 40 per cent. of their protein and 26 per cent. of their sugar, whereas the boiling of cabbage robs that vegetable of from 5 to 10 per cent. of its protein, over 30 per cent. of its soluble carbohydrate, and about 50 per cent. of the mineral salts. Such cooking losses are, unfortunately, not confined to vegetables, for experiment has shown that a boiled meat loses 37 per cent. of its fat and 67 per cent. of its mineral matter, and the roasting process lessens the food value of the meat to the extent of 57 per cent. of these food substances. Since the cooking of our foods is accompanied by such large losses of nutritive material, the economical housewife can make good use of this "lost" material in gravies and soups.

Beans Are Called a Substitute for Meat. Are They as Easy to Digest?

The pulses or legumes, including beans, peas, and lentils, contain a higher percentage of protein than do any of the other vegetables. The principal food substance in meat is protein; therefore, from this standpoint beans are more satisfactory meat substitutes than are green vegetables, such as lettuce and spinach, or the starchy vegetables, such as the potato or sweet-potato. In fact, a pound of dried beans contains more protein and at least 50 per

cent. more heat units (calories) than a pound of most meats. Some persons find beans difficult to digest, but there is no reason why the average normal person should not digest baked beans satisfactorily, provided the beans are properly cooked. Beans are low in fat, hence the practice of combining them in the diet with a fatty food, such as pork or bacon, is a wise one. They also contain more calcium, the bone-building element, than do other vegetables, and, moreover, contain considerable sulphur, which fact frequently leads to the formation of much gas (hydrogen sulphide) in the bowel. The legumes, as a class, leave the stomach rather sooner than meats, baked beans generally being the last of the legume family to make their exit. The gastric juice poured out upon meat is "stronger" than that furnished the legumes. This is due at least in part to the "extractives" present in the meat.

Is Rice a Satisfactory Potato Substitute?

Both rice and potatoes are good foods when properly used. They are, however, in no sense rivals for "gustatory honors." The potato is a vegetable, whereas rice, although served as a "vegetable," is, nevertheless, not a vegetable, but belongs in the class of cereals along with wheat, rye, oats, corn, and barley. Not only do rice and potatoes belong to different classes of foods, but they

are decidedly different in composition. The great bulk (87.7 per cent.) of the rice grain is made up of protein, fat, starch, and mineral matter, whereas the flesh of the potato is principally water (78.3 per cent.). Upon more minute comparison we find that rice contains three times as much fat, over three times as much protein, and over four times as much starch as does the potato, and that a given weight of rice yields over four times as many heat units (calories) when it is burned in the body. These differences are pronounced, but still another important one exists. One of the main purposes of our food is to yield heat or energy to the body. Thus the body burns the food much the same as a furnace burns coal. When rice and other cereals burn in the human furnace an excess of "acids" is produced, whereas the burning of potato and other vegetables produces an excess of "bases" (the opposite of "acids"). Now, everything is useful in its place, but it would be disastrous to make heterogeneous substitutions. Thus the "acid" in the stomach aids in the digestion of our food, while the "base" in "Old Dutch Cleanser" aids in cleaning the sink, but it would be utterly futile to attempt to digest our food with "Old Dutch Cleanser" or to clean the sink with gastric juice. So it is with rice and potatoes—they are both useful foods, but are not interchangeable. Potatoes are low in protein and should be eaten

along with meats which are high in protein and which form "acids" when burned in the body. When we serve rice instead of potatoes with meat we are serving two "acid-formers." No harm is done by this procedure if the diet contains a sufficient quantity of "base-formers" (fruit and vegetables) to offset (neutralize) the effect of the acid produced. It is quite essential that our diet shall consist of such foods as insure for us a rough "balance of acids and bases."

How Does the Stomach Handle Mushrooms?

Mushrooms are fungi, not vegetables. They are classed as "edible fungi" to differentiate them from the "toadstools" which are "inedible" because of the presence in them of poisonous substances. The poisons present are generally alkaloids, one prominent toadstool poison being the alkaloid muscarine. It is claimed the Czar Alexis was killed by eating toadstools containing this poison. Many people think that mushrooms have a high food value. In fact, it has been claimed that they are somewhat similar in composition to beefsteak and the mushroom has been called "vegetable meat." This conception of the mushroom is entirely erroneous, for this edible fungus has very little food value. Furthermore, the small amount of food substance present is not readily available because of the mushroom's relative indigestibility.

The stomach makes a brave attempt to digest the mushroom, and greets it with a digestive fluid (gastric juice) which is very similar to that produced in the stomach when "real food" is eaten. However, the best the stomach can do is to reduce the fungus pieces to a form somewhat resembling thin scrap leather with frayed edges and pass them into the bowel.

Do Green Vegetables Act as Spring Tonics?

These vegetables are important articles of diet entirely apart from their actual food value, as explained by me elsewhere (see page 111). The iron of spinach and other green vegetables aids in maintaining the iron supply of the body at the normal level, thus insuring proper blood for our body. However, the attempt to demonstrate that various vegetables have important medicinal properties has not met with great success, although most extravagant claims are made. Thus we are told that watercress will "cure" neuralgia, nervous exhaustion, scrofula, and "remove pimples"; that lettuce and celery "rest the nerves"; that onions "aid digestion" and stimulate the circulation of the blood; that carrots "prevent dyspepsia"; that cucumbers "cool the heated frame," and that the dandelion "helps the liver to do its work." So far as I know, not one of these statements has any experimental basis. Some books on foods and dietetics are full

of such statements as the above. The green vegetables are good things to eat and will doubtless do us less harm and may do us more good than certain "patent" tonics, but why place the responsibility for the health of the whole family upon the cucumber and the carrot?

How Do Beets and Radishes Act in the Stomach?

The boiled red beet leaves the stomach very rapidly (one and one half hours). If the beets be pickled they leave even more rapidly (one hour). One thing characteristic of the beet is that it produces a red solution in the stomach, due to the fact that the coloring matter of the beet is soluble in gastric juice. The pigment in the skin of the radish is also soluble in the acid contents of the stomach and yields a pinkish solution. The radish leaves the stomach in about the same time as the beet and "stimulates" the stomach in much the same way. The beet, however, has important food relationships which are denied the radish. The "beet-sugar" industry bears testimony to this fact. "Beet flour" has also been used, mixed with wheat flour, in the making of bread.

Does the Eating of a Starchy Vegetable Cause the Stomach to Grow Larger?

The eating of vegetable foods in moderate quantity will have no more influence upon the size of

the stomach than will the eating of a moderate quantity of any other food. If we continually force our stomach to carry the "maximum load" because of our tendency to "overeat," we must expect ultimately to "pay the cost" in the form of a distended stomach. Vegetables follow the law established in our work upon other foods in that a small weight of vegetables leaves the stomach sooner than a large weight. As a class, vegetables leave the stomach more rapidly than meats and eggs, for example.

Why Is Baked Potato One of the First Solid Foods Given to Invalids and Children?

Because the starch of the baked potato is believed to be in a form in which it is particularly easy to digest. The starch in the uncooked potato is inclosed in cells which possess a more or less insoluble and indigestible wall of cellulose material. Each cell contains a number of starch granules. However, in the baking process the indigestible cell wall is blown open by means of steam which has been generated in the cell, thus freeing the starch. Some of the starch granules themselves are also blown open by steam. Consequently, when such a potato is eaten the starch-digesting ferment (ptyalin, or salivary amylase) of the saliva is able to come into more intimate contact with the starch, thus initiating the digestion of this foodstuff while the potato is being chewed. Baked potatoes are

also rather more nutritious than boiled potatoes. This is due to the fact that food substances have been removed from the boiled potato in the process of boiling, whereas the baked potato loses nothing but a little water, which escapes in the form of steam. In spite of the above facts, our experiments failed to show that baked potatoes left the stomach more quickly than potatoes cooked otherwise. In fact, in some cases fried potatoes were passed into the bowel sooner than were baked potatoes. One stomach emptied German fried potatoes in one hour and a half, whereas it took four hours to rid itself of baked potatoes. We thus have "inside information" that this stomach is pro-German.

Are Cassava Roots Digestible?

Yes! The cassava is widely grown in the American tropics, and its cultivation has been extended to the Southern section of our own country. In Florida, for example, the cassava is extensively grown. It forms a cheap source of commercial starch, glucose, and alcohol, and is used by man as a vegetable. There are two varieties of cassava, the bitter and the sweet, but the cultivation in this country is limited to the sweet variety. In flavor the cassava somewhat resembles the dasheen (see page 60). In composition it is similar to the dasheen in some features (fat, starch, and heat units), whereas in others (protein and mineral

matter) it more closely resembles the potato. There is no outstanding reaction of the stomach toward the cassava which would serve to definitely differentiate it from the dasheen and potato. The cassava in most cases leaves the stomach rather more slowly than the potato.

How Do Rice and Barley Compare as to Digestibility and General Food Value?

If we wish to force one of our "noble cereals" to "serve in the ranks" as a common vegetable, we could do no better than to make barley our selection. It resembles rice in composition, but contains more protein, fat, and mineral matter. Since it is cheaper than rice, the housewife will "get more for her money," and will not exceed her "allowance" so quickly in these days of excessive food cost, if she calls barley to her assistance. Boiled barley, for example, is a most satisfactory food and possesses a flavor which appeals to many persons rather more than does the flavor of boiled rice. Barley has about the same food value as wheat and makes excellent biscuits. So far as the digestion of rice and barley in the stomach is concerned, our tests indicate that boiled barley digests rather more rapidly than does boiled polished rice, and leaves the stomach sooner. The natural brown (unpolished) rice is passed into the bowel in about the same time as barley.

Are Cucumbers More Digestible When Soaked in Salt?

No! There is a wide-spread notion that cucumbers contain something which interferes with digestion and which is removed when the sliced vegetable is permitted to stand overnight in salt and water. There is apparently no basis for this belief. In fact, the entrance of the salted cucumber into the stomach caused the manufacture of a less satisfactory type of gastric juice than that produced when the plain, unsalted vegetable was eaten. So far as the "evacuation (emptying) time" of the stomach is concerned, our tests indicate that the stomach holds each type of cucumber preparation for about the same period before permitting it to enter the intestine. There are many stomachs which show signs of distress when cucumbers are eaten, but there are just as many stomachs which handle the vegetable in a most satisfactory manner. In fact, I have in mind a family, every member of which eats cucumbers at each of the three meals of the day when the vegetable is available, and in no instance has any digestive distress been noted.

Is a Steak "Smothered in Onions" Difficult to Digest?

The addition of an ounce of fried onions to a three-ounce steak does not materially influence the digestion of the steak in the stomach. Likewise,

the addition of mushroom sauce to a steak does not interfere with the digestion of the meat, although the mushrooms themselves are rather indigestible, as we have already indicated (see page 124). When properly priced, onions are a useful food, but when they cost fifteen cents a pound, as they did when we made our experiments, it is poor economy to serve "onionized" steaks, for the food value of onions does not warrant their use at the price mentioned.

Do Our Stomachs Cry for Potatoes Three Times a Day?

If they do, the cry is exceedingly faint when potatoes cost four dollars a bushel, which was the price at the time we studied them. If we wish to eat potatoes in moderate amount three times a day, there is no reason why we should not do so. If we must have a "continuous food performance" of this kind it is far better for our stomach and all other parts of our anatomy if we make a good staple vegetable, such as the potato, our choice, rather than some form of meat.

Which Is More Digestible, Lettuce with Sugar and Vinegar or Lettuce with Oil and Vinegar?

These two lettuce preparations are treated about the same by the stomach. Our tests indicate that the plain lettuce leaves the stomach rather more quickly than when sugar and vinegar or oil and vinegar are added. So far as the food value of lettuce

salad is concerned, the body derives much more energy (calories) from the mayonnaise dressing than from the lettuce itself. However, green vegetables are not eaten for their heat-yielding qualities.

How About the Digestion of Cauliflower and Tomatoes?

The cauliflower has been called "the most easily digestible of all vegetables." One of our stomachs evidently thought otherwise, for it passed boiled cabbage into the bowel in one hour and a half, but required three hours and a half to do the same service for boiled cauliflower. The tomato is a useful vegetable, whether raw or cooked, but its food value, like that of many other vegetables, is low. In fact, it would be necessary to eat nearly ten dollars' worth of sliced tomatoes with lettuce and mayonnaise dressing in order to secure the same number (2,500) of heat units (calories) as are present in fifteen cents' worth of bread. Raw tomatoes leave the stomach more rapidly than stewed.

How Does Sauerkraut Digest as Compared with Boiled Fresh Cabbage?

Sauerkraut leaves the stomach rather more slowly than either boiled or raw cabbage. The stomach evidently likes it, however, for the gastric juice which is formed upon the entrance of sauerkraut is nearly 50 per cent. "stronger" than that with

which the stomach greets cabbage in the other forms. We do not ordinarily associate the turnip with sauerkraut, but, nevertheless, in the stress of war, "turnip sauerkraut" was manufactured in Germany. We have made no tests on "turnip sauerkraut," but we know from our experiments that boiled turnip is about as easily digested as boiled cabbage.

Is the Dasheen a Good Food?

Yes! The dasheen is a very popular vegetable in tropical and subtropical countries, and is used, in general, in the same ways as the potato and the sweet-potato. It grows well in moist soils and assumes the form of large underground rootstocks, or corms, to the sides of which are attached small corms (cormels). The United States Department of Agriculture has experimented with the dasheen in the hope of demonstrating that it may be successfully grown in the moist, rich soils of the South Atlantic and Gulf States. In food value the dasheen excels the potato, for analyses show that it not only yields more energy or heat units (calories) when burned in the body, but that it also contains more of those essential food constituents, starch, fat, mineral matter, and protein. It "tastes" much the same as potato, with an additional nutty flavor. The flesh of the dasheen sometimes becomes grayish or violet in color after cooking, but the

flavor of the vegetable is not altered by this color change. We have found that dasheens, either boiled (riced), baked, or fried, as soon as they reach the stomach cause the formation of a gastric juice which is fully as "strong" as that manufactured by the stomach when potatoes are eaten. In spite of this fact, however, the dasheen, in the majority of cases, remains in the stomach longer than potatoes similarly cooked.

What Does the Stomach Say to Fried Potatoes?

Our stomachs did not share the popular prejudice against fried foods. In fact, the average "evacuation (emptying) time" for fried potatoes was shorter than that for baked and boiled potatoes. We were interested in observing that our tests showed that French fried potatoes were "interned" in the stomach about 40 per cent. longer than were German fried. This observation indicates that our stomachs were not at all "anti-German," in spite of the fact that our country was on the verge of war with Germany when these tests were made. Plain fried potatoes and potato chips are also good digestible forms in which to serve potatoes. Emphasis is ordinarily laid upon the digestibility of baked and mashed potatoes. This is all very proper, but our tests indicate that fried and boiled potatoes are just as satisfactory forms in which to eat the potato.

Is It True That Many Vegetables Are Principally Water?

Yes! In fact, many of them contain more water than there is in milk (87 per cent.). Cucumbers contain 96 per cent.; lettuce and endives, 94 per cent.; celery, over 93 per cent.; tomatoes and asparagus, 92 per cent., and many others, including cabbage, cauliflower, and spinach, 90 per cent. or over. Cooking serves to still further increase the water content of the vegetable. This increase is generally at least 2 to 3 per cent., and may amount to 10 per cent. or more in the case of such vegetables as parsnips and artichokes. Thus when the housewife pays ten cents a pound for cabbage, which is the market price as this statement is written, she pays nine cents for nine-tenths of a pound of water and buys "dry" cabbage at the rate of *a dollar a pound.* We consider this a rather high price for "cabbage water" and "dry" cabbage, notwithstanding the recent claim of a food "expert" that "cabbage is the *healthiest* of all vegetables."

What Does the Stomach Say to Vegetables as Compared with Meat, Milk, Bread, and Eggs?

The stomach history of the average vegetable is much shorter than is the stomach history of meat, milk, bread, and eggs. Each of the four

last mentioned foods undergoes very pronounced changes in the stomach. With many vegetables the condition is decidedly different. Spinach, lettuce, cabbage, celery, and rehto vegetables which contain very little protein, but considerable cellulose (woody material), are not subjected to very great changes in the stomach. The body must rely upon the digestion processes in the bowel to care for these foods. With other vegetables, and in particular the pulses or legumes, such as beans, peas, and lentils, the situation is different. These forms of vegetables contain considerable protein and comparatively little cellulose, and they are consequently much altered during their stay in the stomach. The main bulk of the digestion of important starchy vegetables such as the potato and sweet-potato occurs in the bowel, although they are considerably changed in the stomach, principally through the action of the saliva, with which the vegetables become mixed in the mouth. Here again, however, we see emphasized the fact that all stomachs are not alike, since any given vegetable is not passed into the bowel in the same time from all normal stomachs.

CHAPTER VIII

DO OUR STOMACHS LIKE ICE-CREAMS AND COLD DRINKS?

That the children as well as the "grown-ups" of America like ice-cream is proved by the fact that they spend over two hundred and fifty thousand dollars a day for the privilege of eating it. That these same Americans are also a thirsty lot is indicated by the fact that Uncle Sam must draw a check every day for more than five hundred thousand dollars to pay for the "soft" drinks his children introduce into their stomachs. In fact, there is more money spent for "soft" drinks in the United States than in all the rest of the world combined. What the American stomach thinks about this matter of ice-cream and cold drinks is indicated in the answers to the following questions:

Is Ice-cream Held in the Stomach Until It Becomes Body Temperature Before Digestion Proceeds? Is This True of Cold Drinks?

When ice-cream is taken into the stomach it has been shown that most of it remains for several

minutes in the first part (fundus) of the stomach until it has been warmed up somewhat, when it gradually passes into the lower part (pyloric portion) of the stomach, where the main part of the digestion occurs. Some digestion, however, takes place before body temperature is reached. While it is true that the majority of the digestive ferments (enzymes) of the human body act best at body temperature (98.6 degrees F.), it is also true that they still act, only somewhat more slowly, at temperatures much below that of the body. If we freeze such a ferment in a block of ice the ferment loses all power to act. However, if we thaw the ice and liberate the ferment it goes about its business and acts much the same as it acted before its stay in the prison of ice.

When a dish of ice-cream is eaten by a normal person "on an empty stomach" it takes the stomach less than fifteen minutes to readjust its temperature to within a few degrees of the normal, and in from twenty-five to thirty-five minutes the normal stomach temperature is re-established. The slowing of stomach digestion is, therefore, not pronounced, and such slowing as does occur takes place principally during the fifteen-minute interval immediately after the ice-cream is eaten. If we consider that the average stomach completes digestion in about three hours (180 minutes), it is apparent that the mere slowing of the process for

fifteen minutes at its start cannot possibly do any pronounced harm. The above statements regarding ice-cream apply as well to the action of cold drinks in the stomach.

Is It True That Ice-cream Contains Bacteria?—If So, Is It a Good Food?

Yes, ice-cream contains bacteria. This is true of all ice-creams. It cannot be otherwise under ordinary circumstances, since milk contains these germs and milk or cream is used in making good ice-cream. If the milk and cream are handled in a sanitary way, the bacteria present will be harmless ones. On the other hand, if unsanitary conditions prevail in the handling of the milk and other ingredients of the ice-cream, or if the ice-cream is marketed in an unsanitary manner, then some of the bacteria present may be found to be such as will cause disease (pathogenic bacteria). However, in these days, when much emphasis is being laid upon pure-food sanitation, one can feel reasonably safe in eating ice-cream even of average grade. Sterilizing the cream before freezing is a desirable precaution.

Even with its large and thriving family of bacteria (which may amount to many millions per spoonful), ice-cream must be considered a good food and easy of digestion. The housewife can guard against the presence of undue millions of

germs in the ice-cream of her boy and girl if she will take the trouble to freeze her own cream. This can readily be done with the aid of the youngsters, who are ever ready to assist in the preparation of this their favorite food. In this way the parent may offset the allurements of the "hokey-pokey" vender and his all too often germ-infested product.

Does the Eating of Ice-cream Followed by Hot Coffee at Dinner Cause Difficulties?

No! The temperature of ice-cream ranges from 18 to 21 degrees F., whereas coffee at 122 degrees F. is about as hot as one wishes to drink. The drinking of hot coffee after ice-cream raises the temperature of the food substances in the stomach and thus lessens the cooling effect of the ice-cream upon the stomach walls. Digestion, therefore, proceeds more quickly when ice-cream is followed by hot coffee than when no coffee is taken. (For other influences of coffee see Chapter II, page 19.) If a hot drink is not taken to assist the body in raising the stomach temperature to the normal point, the body must use its own heat to bring about the temperature change. About ten thousand small calories of heat are required to raise the temperature of half a pint of ice-cream from 19 degrees F. to the temperature of the body, whereas a half-pint of ice-water at 50 degrees F.

may be raised to the temperature of the body by a little more than one-half that amount of heat.

Does "Hot" Ice-cream Digest Any Better Than Cold Ice-cream?

To get "hot" ice-cream we took ordinary vanilla cream, melted it, and heated it up to body temperature (98.6 degrees F.). We found that the stomach did not respond any more favorably to this "hot" ice-cream than it did to the regulation ice-cream, which was 77 degrees colder. We may conclude from this that the temperature of ice-cream has very little influence upon its digestion in the stomach. The cold ice-cream, because of its low temperature, causes the glands of the stomach to manufacture a little less gastric juice than usual for a few minutes after the ice-cream is eaten, but body temperature is soon reached, and then everything swings along in the same old way. The fact that cold ice-cream is more palatable also tends to aid in its digestion.

How Long After Eating Before Ice-cream Begins to Digest? Are Ices or Sherbets Digested More Rapidly Than Ice-cream?

The ice-cream begins to digest very soon after it reaches the stomach. The first part of digestion is retarded somewhat because of the low tempera-

ture, but in about half an hour the stomach re-establishes the normal temperature and digestion is rapid. Ices and most sherbets are digested somewhat more rapidly than ice-cream, because of the absence in them of fat and protein substances. These are, nevertheless, the very things which make ice-cream a better food than the sherbet or ice. A first-class ice-cream should contain about 14 per cent. of butter fat. This is the standard suggested by the United States Department of Agriculture. However, one often meets with ice-cream which contains only 8 per cent. or less of fat. In fact, this is the minimum percentage permitted by the laws of Pennsylvania and seven other states. Such cream often contains a "thickener" or "modifier," which is added to give the ice-cream the appearance of richness while increasing its water content. On the other hand, the very lack of richness of ices and sherbets makes them the more desirable as light refreshments taken between meals.

Does the Eating of Ice-cream with Cake or Pie Interfere with the Digestion of Those Foods?

No! The eating of ice-cream along with cake or pie leads to the formation of a more satisfactory gastric juice than is produced when cake or pie is eaten without the ice-cream. There is apparently little basis for the claim that ice-cream, because of

its low temperature, interferes seriously with digestion in the stomach by checking the activity of the glands which manufacture the gastric juice. It must, of course, be borne in mind that ice-cream, under favorable circumstances, is a rich food which itself requires a moderate time for digestion. In fact, it is one of the most nutritious of desserts, due to its high content of fat and sugar. It is rather low in protein, however.

What Is the Effect of Eating Ice-cream at the End of a Meal?

The ice-cream will cool the contents of the stomach for a few minutes and then cause digestion to "slow down" a bit. However, a similar cooling occurs after cold water is taken, and in spite of this fact the body ultimately derives more benefit from food taken with the water than without. When ice-cream is added to a meal the stomach may empty a little more slowly than usual, due to the fact that the ice-cream increases the bulk of the food in the stomach. The milk fat in the ice-cream may also cause the stomach to "evacuate" slowly, since fats, as a class, are "slow-moving" foods. However, this delay of a few minutes in the emptying of the stomach is without significance, and is well compensated for by the increase in food value, provided the ice-cream is of good quality.

Are Frozen Custards More Difficult to Digest Than Ice-cream?

The frozen custard stimulates the stomach much the same as ice-cream, and is digested in about the same time.

What Is the Difference in the Effect of Eating Ice-cream Rapidly or Slowly?

There is no marked difference. The stomachs we studied emptied rather sooner when the ice or ice-cream was eaten rapidly (one to two minutes) than when it was eaten slowly (seven to ten minutes). Some persons get a headache on eating ice-cream rapidly, and they, of course, should go slow. Further, it serves no good object, and might do harm, for any one to habitually eat large dishes of ice-cream in less than two minutes, or to gulp down large volumes of ice-water, as was done in many of our experiments.

Is a Sundae More Difficult to Digest Than Straight Ice-cream?

That depends on the character of the sundae. Fruit sundaes (strawberry, cherry, etc.) digest just as rapidly as straight ice-cream, whereas a nut sundae would digest more slowly, since nuts, as a class, are slow of digestion. However, the quantity of nuts served upon an ordinary sundae will not influence digestion to any considerable extent.

Which Are to Be Preferred, Cold Drinks Made from Natural Fruit Juices or Those Prepared from Artificial Chemical Products?

The most sensible drink for hot weather, and one easily prepared, is ice-water. If a "soft" drink of some sort is desired, preference should be given to those made from natural fruit juices. Soda-waters whose color and flavor are artificial are so universally sold that the term "strawberry soda-water," or "pop," is no longer suggestive of any product of nature. The flavors are generally provided by essences manufactured in the chemical laboratory, together with some organic acid, and the variegated hues are mainly derived from coal-tar dyes which in an emergency could be used to color a scarf. Such preparations, while properly labeled "artificial" and lacking the quality of true fruit preparations, are not necessarily unwholesome or undesirable refreshments. In much "circus" or "pink" lemonade the sourness was due to added citric acid (the acid of lemons). This comes about as near to being real lemonade, however, as a tablet of caffeine does to a cup of coffee. Formerly soda-water often contained a poison (glucoside) known as *saponin*, which is prepared from "soap bark" and was used because it made a nice, "foamy" drink. This saponin is closely related to snake venom and has a harmful effect (hemolysis) upon

the red cells in the blood. A solution of one part of saponin in two hundred thousand of water will kill fish. Although it is now contrary to the Pure Food and Drug Act to use saponin in soda-water, there is still some of the "foamy" soda-water sold.

Why Does "Soda-water" Produce Gas in the Stomach Immediately After It Is Taken?

Soda-water is a term applied to so-called "carbonated," or "charged," water. The "charging" is accomplished by introducing purified carbon-dioxide gas into the water under pressure. This gas is the same one which is formed by yeast in the rising of bread or when vinegar is added to common baking-soda. When such water is taken into the stomach the carbon-dioxide gas is liberated. If considerable soda-water is taken at one time this gas, which is liberated when the water is warmed by the stomach, may cause "belching," or temporary distention of the stomach. Aside from this the carbonic-acid gas does not seem to have any untoward effects. In fact, certain medicinal preparations used for indigestion are carbonated.

Is It Easier to Take Care of an Iced Drink by Sipping It Slowly?

The normal stomach can take care of reasonable amounts of cold drinks irrespective of their manner

of entry. If one drinks a large quantity of a very cold drink rapidly, however, some of it will leave the stomach before this organ has had time to "warm up" the fluid to any extent. Under such conditions the cold drink will have a chilling effect upon the intestine and indirectly upon the pancreas, liver, and gall bladder. If we drink our cold fluids slowly we can take considerable without producing this undesirable chilling effect. In the preparation of drinks in which the ice is added directly to the fluid it is important that the character of the ice be given due consideration. There has been a tendency to look upon artificial ice as the purest obtainable. Recent tests of such ice, however, indicate that some artificial ice is far from pure. Furthermore, we now know that natural ice obtained from ponds and rivers which are not "grossly polluted" is very likely to be fully as pure as the ice made by artificial means. Therefore, if you live near a river or pond in an ice-forming region, safeguard the health of the family by "cutting ice," and incidentally cut the ice-man's bill.

Is It Wise to Take an Iced Drink When One is Overheated from Physical Exercise?

No! When one comes in, physically "down and out" from a long walk, an athletic competition, or "real work," the muscles of the stomach are tired as well as the muscles of the arms, legs, and back.

A "tired" stomach acts differently from a rested one, just as a tired man or woman acts differently from a rested one. It is not wise for the average individual to fill a tired stomach with food and expect it to be properly digested. Some stomachs are equal to the task, but it is an unwise policy for general practice. Likewise, it is not well to drink very freely of iced drinks or to eat excessively of ice-cream or ices when one is overfatigued.

Does the Taking of Cold Drinks at Meals Cause the Food to Digest More Slowly Than When Hot Drinks Are Taken?

No! This point was studied in connection with iced tea and iced coffee. In order to give the cold drink an opportunity to do its worst a quart of the beverage (tea or coffee) was fed with an ordinary meal of meat, potatoes, bread, and butter. On another day, for comparison, the same men were given a quart of *hot* coffee or tea with a similar meal. We found that the digestion of the food proceeded just as satisfactorily when the iced beverage was taken as when a hot drink was substituted for the frigid one.

Which Leaves the Stomach Sooner, Ice-water or a Soft Drink of the Same Temperature?

Ice-water leaves the average normal stomach rather more quickly than other iced drinks, such as

lemonade, root-beer, grape juice, ginger-ale, etc. Both hot and cold drinks generally leave the stomach rather sooner than do drinks of body temperature. As between the hot and cold drinks, the cold beverage leaves rather more quickly than the hot, since it stimulates the movements of the stomach and bowel (peristalsis). Thirst seems to play a part in determining the time a cold drink leaves the stomach. The more thirsty the individual the more rapidly the stomach passes the fluid into the intestine. The sooner water leaves the stomach the more quickly it is absorbed and its effect produced. The relative lack of palatability of lukewarm water may in part be due to the fact that it remains in the stomach longer. However, thirst is in part merely a mouth sensation, which may be overcome without water actually entering the stomach at all.

Which Kind of Ice-cream Digests Most Rapidly, Vanilla, Strawberry, or Chocolate?

If the ice-cream is made from similar ingredients, with the exception of the flavoring substances (vanilla, strawberry, or chocolate) the strawberry will digest most rapidly, and will be followed by vanilla and chocolate in the order named. Creams containing fruit juices are quite likely to digest rather more quickly than other kinds of ice-cream, because the fruits as a class are digested rather rapidly. Chocolate and cocoa are slow of digestion,

due partly to their fat content, and therefore any kind containing them will likewise digest more slowly.

The above statements regarding ice-cream should not cause the housewife to conclude that the strawberry ice-cream she purchases for her children is a better ice-cream than the vanilla ice-cream she may purchase at the same price. The term "ice-cream" covers a multitude of concoctions of different food value. I have already stated that Uncle Sam's ice-cream standard calls for 14 per cent. butter fat, and that the laws of Pennsylvania and seven other states make it illegal to sell ice-cream containing less than 8 per cent. butter fat. Nevertheless, it is a fact, capable of proof, that so-called "ice-creams" have been made *without the use of a trace of milk or cream.* One way this may be accomplished is by the proper manipulation of sugar, syrup, eggs, and a little flavoring which gives an ice-cream of good food value, whereas an ice-cream of poor food value may be produced by the too free use of thickeners and with the elimination of the bulk of the eggs. In contrast with such ice-cream, which contains at most only a fraction of a percentage of fat, stands the ice-cream which contains upward of 30 per cent. of butter fat. This type of ice-cream is far too rich for the average stomach, and especially for the stomach of the child. The mother will do well to bear this in mind when

she makes ice-cream for her babies, and see to it that she does not make too free use of the "60-per-cent. cream" she purchases from the milkman. The average stomach of girl, woman, man, or boy will have trouble in digesting a large load of an excessively rich ice-cream.

CHAPTER IX

THE PLACE OF NUTS AND FRUITS IN OUR DIET

THE United States produces upward of three hundred million dollars' worth of nuts and fruits yearly. The apple crop alone approaches two hundred million bushels per year, whereas the peanuts grown in 1916 sold for nearly sixty million dollars. Over twenty million boxes of oranges are annually shipped, and California alone produces nearly twenty million pounds of walnuts each year. In view of these statistics, we ought to be interested in learning what the stomach has to say to nuts and fruits.

The testimony of the stomach is set forth in the following discussions:

Which of the Common Nuts Is the Most Nutritious?

The pecan has the highest energy value. That is, an ounce of pecans will yield more heat (calories) to the body than an ounce of any other common nut, provided there is the same waste from the intestine in each case. The pecan also has the highest fat content (70 per cent.) of any of the common nuts,

but is low in protein (9.6 per cent.) as compared with the butternut (27.9 per cent.), walnut (27.6 per cent.), and peanut (25.8 per cent.) for example. The almond is also a good, nutritious nut with slightly less food value than the walnut and about equally digestible. At current market prices the housewife probably gets the best value for her "nut money" if she buys the peanut. This nut is about as readily digested as any of the other nuts. Peanut butter is also a good food and undergoes less loss in the intestine than does the original peanut. The peanut-butter sandwich is a wholesome article of diet for the child.

Are Salted Nuts More Digestible Than Unsalted Ones?

Yes! Nuts should never be eaten in any quantity without the addition of salt. The bulk of the protein of the nut is a substance called globulin, which is soluble in salt solution. Therefore, the addition of salt to the nut aids in its solution and digestion. This factor would not be so important in the case of roasted nuts, but even here salt, by making the nuts more palatable, aids in starting off their digestion, which is at best somewhat slow.

Which Does the Stomach Prefer, Nuts or Fruits?

Fruits stand first in the estimation of the stomach, because they are 50 per cent. easier to digest. The

nut, no matter what its name or composition, is a difficult form of food for the average stomach to handle. Unless great care is used in the mastication of the nut there is large loss of nut material from the bowel, and even with the most careful chewing the intestinal loss is greater than that shown by such staple foods as meat, bread, and eggs.

How About Eating Nuts After a Heavy Meal?

It is bad practice to "stuff" ourselves with nuts after we have eaten a heavy dinner, for example. The nut can by no possible strain of the imagination be classed as a "light dessert." The nuts are one of the most concentrated forms of human food.

What Place Does the Chestnut Hold as to Food Value and Digestibility?

The chestnut is an entirely different type of nut from the almond, peanut, and walnut, for example. These nuts are "high-protein" (21 to 28 per cent.) nuts, whereas the chestnut is a "low-protein" (6 per cent.) nut. The chestnut is also low in fat (5½ per cent.) as compared with other common nuts (38 to 70 per cent.). The energy value of the chestnut is also low, being only about one-third that of other common nuts. In its carbohydrate content the chestnut far exceeds any other common nut, the analysis showing 42 per cent. as against an average of less than 15 per cent. for the others.

The chestnut, either raw, boiled, or roasted, is digested satisfactorily if not eaten in excessive quantities.

Should Fruits Be Given to Babies?

Yes! · Certain fruits are a very valuable addition to the diet of babies. Perhaps slightly sweetened orange juice in quantities of a teaspoonful to a tablespoonful is most satisfactory for the first few months. Later other fruits and vegetables may be added. The orange juice will ward off a tendency to scurvy, which some say is due to a lack of "anti-scorbutic" vitamines in the diet (see page 112). Most fruits are rich in these important substances. Fresh milk also contains them, but dependable raw milk is difficult to obtain and is hard to digest as compared with boiled milk. By the addition of orange juice any decrease in "antiscorbutic" substances, brought about by pasteurizing or boiling the milk or for unknown reasons, is compensated.

The importance of fruits for the prevention of scurvy and related conditions is, however, by no means limited to babies. On shipboard or in the trenches, where canned meats and other prepared foods must be used to such a large extent, the lack of fruits is keenly felt. Here the use of lemons is often particularly advantageous. The avidity with which the soldiers in camp assault neighboring fruit

and pie stands has not been especially complimentary to the army ration which is so satisfying in most respects. Happily, the commissary departments are beginning to realize that protein and calories do not tell the whole story of food and efficiency.

Is Fruit a Good Candy Substitute for the Child?

The rapidly growing child needs considerable carbohydrate (starch, sugar, dextrin, etc.) to fulfil its food requirements. The bulk of this should rightly be supplied from cereal and vegetable sources, the wheat preparations and the potato coming first to mind in this connection. But variety is essential, and to give variety the youngster may be permitted candy in small amount and preferably after meals. In the summer-time, however, when the common fruits are in season, it is far better for the child to satisfy the "candy craving" by eating fresh fruit which contains sugar as the principal edible solid. Fresh fruits which are high in sugar include grapes, pineapples, figs, and cherries. Dried fruits such as raisins, dates, figs, prunes, apricots, and citron are also excellent candy substitutes when the fresh fruits are not available. The bulk of the sugar in fruits is fruit sugar (fructose), although ordinary cane sugar is found in fairly ample quantity in some fruits, and especially in the apple, pineapple, and apricot.

How Does the Digestibility of Fruits Compare with That of Other Foods?

The response of the stomach to fruits as a class is more similar to the response to vegetables than to any other class of foods. It takes the average normal stomach about two hours to do its duty by the great majority of fruits and vegetables, whereas the average time for meats, for example, is three hours or more. The more rapid exit of fruits and vegetables is due in large measure to the fact that they do not contain so much of the particular material (protein) which is digested in the stomach as do the meats.

Which Is More Nutritious, Fresh Fruit or Dried Fruit?

Fruits in the fresh state are mainly water. When the bulk of the water is removed in the drying process, we have a more concentrated food. Thus dried figs, dates, and raisins are much more nutritious, bulk for bulk, than is any fruit in the fresh condition. However, fresh fruits, even with their lower food value, are especially desirable dietary articles because of the presence of the "anti-scurvy" vitamines which I have previously mentioned (see page 112). So far as the stomach is concerned, it handles dried fruit about as satisfactorily as fresh fruit. As a war measure much

attention was very properly given to the drying of all forms of fruits and vegetables.

Shall We Eat Our Fruit Raw or Cooked?

Fruits are good foods either raw or cooked. If we take them raw we give the stomach less work to do, and also derive the full benefit of the "anti-scurvy" vitamines which are lowered in quantity by cooking. On the other hand, we take more of a chance with our bacterial foes if we consume uncooked fruit. However, we always have our friend, the gastric juice, with us, and since this juice has shown by past performances that it can cope successfully with the great majority of microbes which infest fresh fruit, we may safely eat our apple, plum, or pear without "looking for trouble" in the form of this or that "germ." Of course, this presupposes that our stomach is normal and has the normal quantity of acid present. Raw fruit should always be thoroughly cleaned before eating, and as an extra precaution may be disinfected if we feel so inclined.

The baked apple and the baked banana are digested with about the same readiness as these fruits in the fresh condition. Considerable sugar is usually added in baking apples. This increases their food value, but we find them to leave the stomach more slowly. There are many abnormal stomachs which handle the cooked fruit far better than the raw.

Which Is Better, Fruit Before or After a Meal?

It is rather better practice to eat fresh fruit *before* a meal, particularly in the morning. The fruit causes the formation of an extra quantity of gastric juice in the stomach, and in this way prepares the stomach for the digestion of the food which follows. If the fruit is eaten *after* a meal it reaches the stomach at a time when its action in causing an increased flow of gastric juice is not needed, inasmuch as food already in the stomach has exerted a similar action. Furthermore, the bulkiness of fruit will further distend the stomach and may sometimes give rise to an unpleasant feeling of fullness. Small amounts of fruit may be eaten either before or after a meal, just as the individual's taste may dictate. When children eat fruit before meals they are sometimes apt to satisfy the hunger demands before an amount of food sufficient for their needs has been obtained.

Those who feel hungry just before retiring might do far worse than to eat a little fruit. It leaves the stomach quickly and causes that organ less trouble than does the ingestion of more solid food.

Why Is It That So Many Persons Cannot Eat Certain Berries?

Such cases would be classed under "food idiosyncrasy" or "food anaphylaxis," which was mentioned

in the chapter on "Eggs" (see page 67). The "strawberry indicator" generally appears in the form of a "rash," but this may also be accompanied by digestive disturbances. However, the strawberry is not the only fruit which imposes upon the hospitality of the human body. If we select a group of one hundred men and women who have had wide experience in fruit-eating, we will probably find that at least ten of them cannot eat certain fruit without experiencing discomfort. But this fact must not prejudice us against the use of fruit in the diet. When you learn by experience that a certain food (be it "fruit, fish, or fowl") does not agree with you, the proper course to follow is to "cut it out." Many "poor" stomachs are made to suffer at dinner-parties because the guardian of the stomach is too polite to refuse food which has been repeatedly protested on previous occasions by the stomach in question. Far better to run the gantlet of the displeasure of your hostess than to wrestle with "idiosyncrasy" or "anaphylaxis"! The words are bad enough, but the pains which are associated with them are much worse. If we overload our stomachs with unsuitable solid and liquid refreshments, in order to be courteous, and then hurry home to lessen the stomach's burden by means of the stomach-pump, we are indulging in a form of exercise which is not calculated to lessen our "dyspepsia" or "indigestion."

In overloading the stomach with raw fruits such as berries, plums, etc., which are never entirely free from bacteria, there is also considerable danger of overtaxing the capacity of the body to destroy these latter, and severe indigestion may result. In these cases the fruit as such cannot properly be blamed.

How Does the Stomach Treat the Banana?

The banana has been called "the poor man's fruit" because it is always in season and readily obtainable at a reasonable price. When we examine into the composition of fresh fruits we find that the banana has greater food value than any other common fruit, its nearest competitor being the grape. However, it is too bulky and contains too little protein and energy to permit its use as the sole article of diet. As set forth elsewhere (see page 167), a man of average size must eat between eighty and ninety bananas to satisfy his protein requirements.

The average stomach will handle the banana all right if it is given the right kind of a banana to handle. This fruit is fully ripe and ready to eat only when the peel is golden in color and freely speckled with brown patches. Some people, children especially, wrongly object to such bananas, and say they are overripe. If we will confine ourselves to such bananas as these we will find

that they will not cause bowel disturbance such as the green banana is apt to produce. Furthermore, it has been shown by experiment that the sugar in a ripe banana is very completely absorbed from the intestine and made use of by the body. On the other hand, if we eat bananas which are not fully ripe, the starch of the fruit has not been as completely changed into sugar and the food substances of the fruit are not as available for the body.

The banana may be eaten either raw or cooked. If eaten raw, we need have little fear of eating harmful bacteria, since the peel serves as a protection against such germs. In fact, the banana has been termed "a fruit in a sterile package."

Is Not, Everything Considered, the Apple the Most Healthful of All the Fruits?

In this country the apple is much more widely used than any other fruit, and it probably deserves its proud position at the head of the list. However, there is no evidence that it is more healthful than the orange or banana, for instance. In fact, so far as the stomach is concerned, the response is much the same to the banana, orange, or apple. The "fruit craving" is satisfied sooner by oranges than by apples. A growing farmer lad, for example, will eat six or eight good-sized apples with great avidity, whereas he will seldom eat more than two or three oranges at a sitting. Such boys

certainly do not serve to increase the bank-account of the family physician if it is true that "an apple a day keeps the doctor away."

Is Rhubarb a Good Substitute for Fruit?

Yes! Bulk for bulk, it has a lower food value than the fruits, but the rapidity of its growth and the low price at which it may be purchased render rhubarb a very acceptable substitute for acid fruits. We should see to it that only the stalks of the rhubarb are used for food, since it has been shown that the leaves contain a small amount of a deadly poison (oxalic acid). The use of the rhubarb leaves as a substitute for other "greens" is therefore unwise, particularly in the diet of children. The death of an English clergyman is reported from eating these leaves.

Recent attempts to increase our war-time food-supply through the use of certain varieties of beans (Burma) not hitherto employed as food have also met with disaster, due to the presence in these beans of a poisonous substance.

Does Fruit Interfere with the Digestion of Cereal and Cream?

No! We have found that oatmeal and cream, for example, are digested rather more satisfactorily if grape-fruit prepares the stomach for their reception. Corn flakes with cream and sliced bananas we

also found to form a tasty and readily digested combination.

Is Not "Raisin" Bread a Particularly Good "Dessert" for a Child?

Yes! Such a dessert is far better for the youngster than many of the more fancy and less digestible concoctions of the cook. In fact, the raisin is a good, nutritious article of diet irrespective of the form in which it is served.

Are Acid Fruits Bad for Any One Suffering from Rheumatism?

No! It is a popular misconception that acid fruits, such as peaches, oranges, plums, lemons, and grape-fruit, should not be eaten by rheumatic individuals. In the course of its transformation in the body the acid of the fruit is changed into alkali, which is the opposite of an acid. For example, it is easy to demonstrate that the eating of large quantities of acid fruit causes the fluid waste of the body to become alkaline rather than acid. The elimination of uric acid, the substance on which the blame for rheumatism is frequently placed, is not significantly affected by eating fruits, and even if it were, it would be of no particular importance, as rheumatism is practically always due to bacteria, uric acid having nothing at all to do with it.

Is Not an Orange a Perfect Drink?

From the standpoint of the water content the orange is not as perfect a drink as are certain other fruits. The watermelon, cantaloup, strawberry, pineapple, and peach are about 90 per cent. water, whereas the orange is somewhat less "fluid." However, the orange is a better "thirst-quencher" than either of the other fruits mentioned. This fact is indicated by the wide use of drinks in which the juice of the orange figures.

Does the Stomach Always Respond the Same to a Given Fruit?

No! In the chapter on "Meats" (page 85) I discussed the influence of the emotions upon digestion. The influence of "mental fatigue" was demonstrated in one of our fruit tests. The course in medicine, while very attractive, is, nevertheless, far from easy, and the students as a general rule are tired both mentally and physically as the end of the year rolls round. To test the influence of pronounced mental fatigue upon digestion we gave one of our medical students three ounces of orange at the end of the college year. We found that it required three hours and three quarters for the stomach to take care of this small amount of fruit. Just four months later, when the medical student was deeply engrossed in the life of a farmer,

with his final examinations a thing of the past, we again introduced the three-ounce orange meal into his stomach. But what a different stomach! It now accomplished in one hour and three quarters what it had previously taken three hours and three quarters to accomplish. In other words, the stomach of the farmer, free from all worries and following the "early to bed and early to rise" schedule, was 100 per cent. more efficient than the same stomach when its owner was "burning the midnight oil" in preparation for the final examinations.

Is Lemonade Too Acid for the Stomach?

Not if the stomach is a normal one. In case the stomach belongs to an individual who is troubled with acid stomach (hyperacidity), a very sour lemonade might cause distress, particularly if taken in large quantity. However, normal individuals may drink reasonable amounts of lemonade without fear of gastric disturbances.

Does the Acid of Acid Fruits Aid in the Digestion of Food in the Stomach?

The acid fruits aid digestion *indirectly* rather than *directly*. This *indirect* aid is due to the fact that the fruit acids cause the stomach to manufacture more muriatic (hydrochloric) acid, which is necessary if our food is to digest properly. How-

ever, the fruit acids cannot, in any sense, be said to function as gastric juice or to replace the acid of the gastric juice. Acidity imparted to the stomach contents by the juice of an acid fruit may be a slight aid to digestion in stomachs which are unable to manufacture the normal amount of hydrochloric acid.

How Much Fruit Should We Eat?

It is repeatedly pointed out in this article that the place of fruit in the diet is one of great importance. We should bear in mind, however, that this is true in spite of the fact that the fruits are low in food value as the term is ordinarily used. Like many vegetables, fruits are in general high in water and in valuable mineral salts, but are low in body-building and energy-producing substances. If an average adult person were to make up his or her daily loss of energy by means of fruit alone, such a person would be required to eat three dozen bananas, twenty-eight large apples, or three sixteen-pound watermelons. To supply the protein generally considered necessary would require seven dozen bananas, one hundred and fifty apples, or seven large watermelons. Clearly, while fruit is a necessary constituent of the diet, to attempt to substitute it for more nourishing foods, especially in the case of children, is a disastrous policy. It has been suggested that not over a fourth of our food money

should be spent for fruits and vegetables where doing so would necessitate reducing the amount of cereals, milk, or meat. This appears quite reasonable.

Which of the Fruits Does the Stomach Like Best?

We have studied about thirty different fruits and have found stomachs which approved of every fruit, although we have not asked any individual stomach to pass upon the merits of the entire thirty. It is a matter of common knowledge that all fruits do not "agree" with all stomachs. Therefore, in order to answer the query we must know the characteristics of the stomach in question.

Is It True That Fruit "Regulates the Bowel"?

Yes! The type of fruit to use for this purpose varies with the individual. The great majority of people will probably find that the apple, orange, date, raisin, prune, and fig are particularly useful in combating constipation. If fruits be eaten in excessive amounts diarrhea may result. This is particularly to be guarded against in the case of children.

Does the Stomach Care for Fruit Salad as We Know It?

An ordinary fruit salad containing six or eight varieties of fruit ought to be "censored" before

being spread broadcast over stomachs of the ordinary variety. The "censoring" may be done individually, but it does not add materially to the pleasure of the hostess to see Guest No. 1 censoring the apple, Guest No. 2 "blue-penciling" the grapefruit, and other guests refusing to pass the pineapple, orange, etc.

How Do Grapes and Raisins Compare as to Digestibility?

Both are good foods and very digestible, the grape somewhat more so than the raisin. One of the "fruit cures" sometimes used with good results is the "grape cure." The diet of the patient generally includes from four to ten pounds of grapes per day. This cure should be taken only after medical advice.

What Does the Stomach Say to the Tangerine as Compared with the Orange?

The stomach is well disposed toward both these fruits, with a slight margin in favor of the tangerine.

Are Strawberries and Cream or Peaches and Cream as Digestible as Strawberries or Peaches Alone?

Yes! Fats are "slow-moving" foods and we would, therefore, expect that the addition of cream to strawberries would delay their digestion. However, when cream is added in moderate amount the

digestion of strawberries proceeds about the same as when no cream is present. The same thing holds for peaches and cream.

Which Berry Is the Most Digestible?

We have studied the strawberry, the blackberry, the blueberry, and the raspberry. Our stomachs refused to show any partiality based on color or composition. They were all readily digested.

CHAPTER X

WHAT OUR STOMACHS SAY TO CAKES, PIES, AND PUDDINGS

In the popular mind cakes and pies are above all else producers of "dyspepsia" and "indigestion." As a matter of fact, however, if eaten in moderation and properly masticated the modern pie and cake are perfectly good foods. So-called "dyspepsia" and "indigestion" are many times not due to any particular kind of food, but rather to the fact that too large a bulk of food is introduced into the stomach in a hurried and unmasticated state. It is not fair to pastry to hold it accountable for all the aches and pains of adult and juvenile stomachs. Any form of food may degenerate into a "dyspepsia producer" if improperly used.

Which Are Considered More Digestible, Cakes, Pies, or Puddings?

Cakes as a class are less digestible in the average normal stomach than are pies and puddings, whereas puddings are slightly more digestible than pies.

Hence the order in which these three classes of pastry fall if listed according to ease of digestion is puddings, pies, cakes. As a class, those puddings which have a gelatin basis are the most digestible. At the same time they are rather less nutritious than many other forms of puddings, but, nevertheless, constitute an admirable light dessert. The more digestible puddings, such as rice, bread, custard, and gelatin, may be given with perfect propriety to very young children.

Would a Piece of Pie and a Glass of Milk Satisfy the Stomach as a Lunch?

That depends upon the stomach as well as upon the amount of milk and pie eaten. What a glorious time the juvenile pie-eaters would have had could they have "done their bit" in the dismantlement of the one-hundred-pound apple pie recently baked in a washtub by an army cook for presentation to the Mayor of Philadelphia! The pie contained half a barrel of apples, five pounds of lard, five pounds of sugar, twenty-five pounds of flour, and a dozen nutmegs. It was three feet and a half in diameter and its lower crust was about two inches thick. There must have been some "pie-crust indigestion" in City Hall circles!

Certainly the "pie-milk" luncheon was much more satisfying a year or so ago when restaurants made four cuts to the pie than it is to-day when

many restaurants are making six cuts. The capacity of the milk glass has likewise decreased. When we come to calculate the actual food value of pie and milk we find that one-fifth of a nine-inch apple pie weighs 5.6 ounces and yields three hundred and sixty-six calories, only four of which represent protein. An eight-ounce glass of milk yields one hundred and thirty-four calories, of which ninety are derived from protein. In other words, the "pie-milk" luncheon yields only about one-sixth the total calories required by an adult man per day. If the discrepancy is made up at the other meals, all well and good. In any event, however, this is no luncheon for a boiler-maker or piano-mover.

Does It Really Cause Nightmare to Eat Pie Late at Night?

Sometimes! But let us not be deluded by the thought that pie is the only producer of nightmare. A well-baked pie, if properly eaten, will be readily digested in a normal stomach either late at night or early in the morning. The human stomach is "open for business" at all hours of the day or night, and the particular hour at which food is introduced into it makes no material difference with its ultimate digestion. However, the stomach is a muscular organ and it tires just as does any muscle of the body. Therefore, if we work hard all day and into the night and then introduce an

over-abundance of heavy food into a tired stomach, we must not be surprised if the stomach "balks."

What Pie Does the Stomach Like Best?

There is no single pie for which all normal stomachs show a preference. However, there are certain pies which are digested rather more readily in the majority of normal stomachs than are certain other pies. Thus most stomachs handle peach, raisin, rhubarb, and pumpkin pie with comparative ease. If the pies are properly made, it appears that the fruit pies as a class are the most digestible form of pies. The rhubarb pie has a rather lower food value than the other fruit pies. Furthermore, it is held in disfavor in some sections just at present, due to the fact that the rhubarb *leaves* have been shown to contain a poisonous substance (oxalic acid). This attitude is unfair to the rhubarb pie, since such pies are made not from the leaf of the rhubarb plant, but from the stalk, to which this objection does not apply.

What Nutritious and Digestible Pie and Cake Substitutes May the Child Be Given?

If it is found desirable, for any reason, that pie and cake be eliminated from the diet of the child, the craving for "sweets" may be satisfied by the inclusion of whole-wheat or graham bread to which

has been added peanut butter, corn syrup, or honey. Each of these combinations is nutritious and easily digested by the youthful stomach. Of course, junket, custard, gelatin, and bread puddings may be safely given to very young children.

Is It True That Eating Cheese with Pie Makes It More Difficult to Digest?

The popular opinion that cheese is an indigestible food has no basis in fact. Cheeses of all kinds are good, nutritious foods which are satisfactorily digested provided they are not taken in too large quantity and are thoroughly masticated. However, these kind remarks do not refer to that species of Welsh "rabbit" which is similar in physical characteristics to a first-class ink-eraser. But even our friend the "rabbit" may be so made as to be a thoroughly good and easily digestible food.

A little cheese with pie adds to the food value of the dish and also increases the pie's palatability to the average individual.

Is the Stomach Better Able to Take Care of Fruit Pies Than Lemon-meringue and Custard Pies?

Fruit pies are digested somewhat more rapidly than are lemon-meringue and custard pies. However, the latter pies have greater food value than have those pies which are made of fruit. A year

or so ago a prominent Western editor said lemon pie should be abolished. This editor must have over-eaten of this delicious pie, for there is no sound dietetic reason for putting an "embargo" on lemon-meringue pie.

How About Mince Pie?

This pie is a little more nutritious than the average pie, but in some stomachs, at least, it is the most difficult of all pies to digest. However, when Thanksgiving arrives, if we do not eat too much turkey I think the mince pie will be digested all right, particularly if the cut be as diminutive as that served in the average restaurant.

What Does the Stomach Say to Pie for Breakfast?

If the stomach resides in New England it most heartily approves of such practice. The majority of people, outside of New England, look upon pie as a food to be served at the midday or evening meal. However, there is no good dietetic reason why a well-baked pie should not be served at breakfast, and particularly is this true of fruit pies which may be substituted for fresh fruit when the latter is not in season. The response of the stomach to pie in the morning is about the same as the response at noon or night. A certain regularity in dietetic habit is desirable, however, particularly in starting off the day.

Is Fruit in Pie More Difficult to Digest Than Fruit Eaten as a Sauce?

Some stomachs find rather more difficulty in digesting fruit pies than in digesting fruit sauces. This is due, in great measure, to the fact that the rich pie crust has a tendency to "slow down" the digestion.

Which Is the More Indigestible Part of a Pie, the Crust or the Contents?

The crust of an average pie is more indigestible than the contents. Of course, there are differences in crusts, the light, fluffy, well-baked variety being more digestible than the heavy, "soggy," underbaked crust.

Does the Stomach Have More Trouble in Taking Care of a Pie Than a Light Dessert After a Heavy Dinner?

If we have partaken of a heavy dinner a little pie, more or less, does not add materially to the stomach's task. However, even at current high prices there is still a tendency for many persons to overeat. Therefore, since "every little helps," why not cut down on both the heavy dinner and dessert?

Is Angel-cake Easier to Digest Than "Devil's-food"?

No! Although our tests on these cakes were made during Lent, at which season it may prop-

erly be considered that the "devil's-food" was under a slight handicap, the majority of our stomachs handled "devil's-food" better than angel-cake. The more rapid digestion of "devil's-food" may perhaps be due to its more granular texture, which permits of a more rapid and thorough mixture with the digestive juices of the mouth and stomach. However, angel-cake made according to accepted standards contains about twice as much protein, but less calories (heat units), than the devil's-food. The high protein value of the angel-cake is due principally to the eggs used in its preparation, whereas the chocolate of the devil's-food accounts in large part for its excess calories.

Can the Average Stomach Handle the Cruller and Doughnut Successfully?

Yes! In popular parlance these staple foods are frequently termed "sinkers" with the idea of giving the impression that their digestibility is similar to that of the lead "sinkers" used by fishermen. As a matter of fact, these crullers and doughnuts, if properly made, are handled by the stomach about as readily as any cake. They possess about the same nutritive value as ordinary chocolate cake, and contain more fat, but less protein, than does bread. Certainly the "crumbly cruller" and the "doughy doughnut" are worthy of at least a small place in the family dietary.

Are Cakes Made with Oleomargarine and Other Butter Substitutes Easy to Digest?

Yes! The prejudice against the use of oleomargarine as a "butter substitute" is dietetically and economically unwise. The standard "oleo oil" margarine sold under the pure food laws of to-day is a good food and costs much less than butter. Cakes made with this "butter substitute" are practically as nutritious and just as digestible as are those in which a high-priced butter is used. It is probably true that butter has a rather higher content of "vitamine" than has the margarine or other common fats. However, the ordinary mixed diet, if it contains milk or eggs, will furnish sufficient of this vitamine to insure us against the harmful results which would follow the prolonged ingestion of a diet deficient in this important substance. Beef and mutton fats mixed with lard also produce a good shortening material, as do the nut oils such as cocoanut oil and peanut oil (butter). A widely advertised "hydrogenated" vegetable oil is also a good shortening agent and has been shown to be just as digestible as lard.

Is New Fruit Cake More Digestible Than Old?

No! The flavor, however, improves with age. If Solomon had been wise enough to have made a contract with his caterer to furnish him, at the time

of his first matrimonial venture, sufficient fruit (wedding) cake to serve at his six hundred and ninety-nine later "ventures" he would have been able to have regaled his seven-hundredth bride with a most appetizing cake with unimpaired digestibility.

Which Does the Stomach Prefer, Cakes or Cookies?

Cookies! No matter whether they are ginger snaps, spiced cookies, or just plain "cookies" such as "grandmother makes," they are all rather more attractive to the stomach than the more expensive cakes. Cookies, as a class, are also more nutritious than cakes, due partly to their low water content. Gingerbread is also a good food which is fully as acceptable to the average stomach as are more expensive cakes, such as chocolate layer cake, for example

Is the Cinnamon Bun a Healthful Food for a Child?

Yes! The cinnamon bun, as well as ordinary "raisin bread," are digestible and nutritious foods which appeal to the palate of both young and old.

Should We Eat Cake When It First Comes Out of the Oven?

Yes, if you like hot cake and are held in sufficiently high repute by the cook to enable you to

get it, by all means eat it. The idea that hot bread or pastry is indigestible is not borne out by experiment. These hot foods are welcomed by the normal stomach and are just as easily digested as are their cold associates.

Does the Use of Cold-storage Eggs in Cake Lower Its Digestibility?

No! The cake made according to a "fresh-egg recipe" is no more digestible than the cake which is concocted by means of a recipe entailing the use of cold-storage eggs. The stomach refuses to discriminate against the cold-storage egg, either as an individual food or in cake (see page 67).

Are Cake and Ice-cream, or Pie and Ice-cream, Good Food Combinations?

Yes! The digestion is generally "slowed" somewhat upon the addition of the ice-cream, but the combination has far greater food value than the pie or cake alone possesses.

Is Strawberry Shortcake a Digestible Dessert?

Yes! The sponge-cake type of shortcake is digested much the same as ordinary sponge cake, whereas when the cake portion is replaced by a biscuit dough the shortcake possesses the digestibility of wheat bread or biscuits.

Are Bread and Sauce as a Dessert Easier to Digest Than Cake with a Sauce?

Yes! Bread alone is easier to digest than cake alone. If the same amount of sauce be added to each, the bread combination will digest more rapidly than the cake combination. The excess fat in the cake over that present in the bread is a factor in delaying digestion.

Is It More Difficult to Digest Plum Pudding Than Bread Pudding?

Yes! The average bread pudding is considerably easier of digestion than is the average plum pudding. This is due in part to the fact that the bread pudding is easily permeated by the digestive fluids, whereas plum pudding is of a firmer consistency and the fluids cannot, therefore, "soak in" as rapidly and thoroughly. More bread pudding should be eaten in every household. Bread is truly the "staff of life," and there is no better way to utilize stale bread than to transform it into a tasty pudding.

Is It Harder to Digest Rice Pudding with Raisins Than Without?

No! Either form of pudding is easy of digestion. The inclusion of raisins increases the food value of the dish and at the same time pleases the average juvenile.

Does Tapioca Pudding Appeal to the Stomach?

Both apple and plain tapioca pudding are readily digested, the stomach having a slight preference for the apple tapioca. This is a moderately nutritious pudding, being composed principally of carbohydrate material.

Is Cup Custard a Good Dessert?

Yes! This is a very nutritious pudding. Indian-corn pudding, rice pudding, bread pudding, and corn-starch pudding (with milk) are also good, nutritious, and readily digested puddings.

CHAPTER XI

WHAT OUR STOMACHS REALLY SAY TO CANDIES

BEFORE the World War, the world's cane-sugar, and beet-sugar production aggregated over thirty-seven billion pounds per year, whereas, one billion pounds of glucose and grape sugar were yearly manufactured in our country alone. The importance of sugar in the diet of man is unquestioned. That this point is appreciated by Americans and their English allies is shown by the fact that the per capita consumption of sugar before the war was eighty-five pounds in this country, and ninety-five pounds in England, whereas, in 1917, America's sugar consumption increased to 88.3 pounds per person. Our per capita sugar consumption was twice that of France, and nearly eight times as great as Italy's.

In spite of attempts to conserve sugar, the candy manufacturers say they sold more candy than ever during the war. This increased sale was due to three factors, first, the fact that many people who formerly used considerable alcohol used candy to replace a certain quota of their "booze"; secondly,

large quantities of candy were sent to our troops, and thirdly, the increased wages of laborers tempted them to spend more for luxuries, such as candy. During the Spanish-American War, which was a toy war compared with the great World War, one candy firm shipped over fifty tons of confections to our troops in Cuba, Porto Rico, and the Philippines. If a few thousand troops consumed so much candy we hesitate to estimate on the candy consumption of two million "Yanks." It is probable that the outlay for confectionery in the United States during 1918 outstripped one hundred and eighty-five million dollars, which was our candy bill for 1916. This condition is rather startling in view of the fact that the sugar supply of our ally, France, was then reduced to a very low ebb, each person being allowed only one pound per month. However, many of the women and children of America, who own the majority of our "sweet teeth," cut down their use of confections and thus did their "bit."

How our stomachs "stand up" under a fusillade of bonbons and "lollypops" may be gathered from the following discussions:

What Kind of Candy Is Really Best for Children?

The child should be encouraged to eat *hard candies* in preference to the softer varieties. Pure rock candy, and lime, lemon, and hoarhound lozenges, are entirely suitable for children, or for

"grown-ups," for that matter. These candies should be sucked and not crushed by the teeth. If hard candies, such as those named, are eaten a small amount of candy solution is continuously flowing into the stomach where it is readily handled. On the other hand, if soft candies are eaten there is a tendency to consume a much larger quantity of the "sweet" and as a result the stomach is burdened with a larger quantity of a much thicker sugar solution which is decidedly more difficult to take care of. In fact, both the stomach and bowel dilute such solutions in order to overcome their irritant action and to make easier the further manipulation of the material. This diluting is accomplished by passing a fluid through the wall of the stomach or bowel, as the case may be. Therefore, it is at once apparent that we can save the stomach and bowel much labor and concern if we eat hard candy. Those who prefer to eat comparatively large quantities of the softer confections may assist in the digestion and absorption of the candy solution by drinking freely of pure water.

Candies which are "wrapped" should be bought in preference to those sold "in bulk." From a germ-laden container to a dirty scale, by means of a dirtier hand, is a poor itinerary for a self-respecting candy which is destined to end its life-history in the stomach of an underfed school-girl. The candy venders who infest the vicinity of many public

schools in our large cities are a menace to the health of the boys and girls. Wise parents will see to it that the candy eaten by their children is first "officially inspected" by the "parental censor." The purchase of candy toys such as animals, marbles, etc., is not desirable. They are pretty sure to be eaten sooner or later, and the youngster's stomach is hardly the proper repository for candy which has been in contact with little hands and the floor of the nursery.

How Much Candy May One Eat Per Day?

The eating of candy should not be a routine daily practice, particularly for children. The child should early be taught that "candy day" comes only once or twice a week and that on such days it may expect a few pieces of pure candy, which is to be eaten slowly, after meals. Of course, if the mother is wedded to the habit of consuming a couple of pounds of rich chocolate creams at one sitting, the enforcement of this "candy day" program is rather difficult. The daily ingestion of large amounts of rich confections, between meals, is a custom altogether too widely practised. It is an atrocious dietetic habit, and one which materially increases the high cost of living, if the candy is "high grade." Many a wife may give "first aid" to hubby's anemic bank-account and set a good example for her children if she will eschew the bonbon and

chocolate cream and embrace the lowly lollypop and its confreres.

Is Candy Really a Food?

Yes! The bulk of most candies consists of sugar, whereas butter, chocolate, egg-white, and other food substances are used in certain classes of confections. The white of egg, butter and sugar whose identity is masked in the maze of a special confection are as truly foods as the white of a poached egg, the butter on your toast or the sugar in your coffee. In other words, no matter in what form such substances are introduced into your body they are still foods. A small amount of good candy taken at the proper time is no detriment to a normal person either young or old. The sugar of the candy is burned (oxidized) in the body to yield heat. Every man and woman needs to eat food containing at least 2,500 heat units (calories) every day. If on certain days we consume a given number of calories in the form of candy we may reduce, by that much, our calorie intake in the form of other foods. Thus an ounce of chocolate fudge, maple sugar, or honey each yields in the neighborhood of one hundred calories when burned in the body.

Does the Eating of Candy Cause Decay of the Teeth?

That depends upon the habits of the candy eater relative to mouth hygiene. It has been shown,

by Professor Gies of New York, in some excellent experiments, that certain "mouth bacteria" (*acidophilus* and *placoides*) ferment common sugars and produce acids which have the power of dissolving the tooth substance. If we permit our children to eat candy at night and to go to bed without brushing their teeth we are giving the germs of the mouth an excellent opportunity to ruin the youngsters' teeth. If we may rely upon the dental reports from many of our public schools, the percentage of children which have but slight acquaintance with the tooth-brush is very large. "Clean mouths" are rare articles even in families well regulated hygienically and otherwise. In order to keep the family supply of sound teeth intact let us see that the eating of candy is followed by the cleansing of the teeth by the brush or by the drinking of copious draughts of water.

What Does the Stomach Say to Honey?

The response of the stomach to honey is very similar to its response to sugars. In fact, honey is about 75 per cent. sugar, the principal "sweeteners" present being glucose (dextrose), fruit sugar (levulose), and cane sugar, the latter being present in very small amount. The flavor of the honey is due to certain volatile substances which the bee extracts from the flower. Bread and honey is a combination which "looms large" in the average

juvenile eye. It has good food value and is well digested provided the child can curb its desire to use more honey than bread. If we take milk along with the bread and honey we have a very satisfactory combination for luncheon. Our country would profit thereby if we had a freer and more steady flow of "milk and honey" into the stomachs of young America in place of the artificial sweets of which many are permitted to overeat.

Is Refined Sugar as Good a Food as the Sugar in Fruits and Other Products of Nature?

No! "Nature's sugar" is an entirely different article from the product of the sugar refinery. In nature we find sugar intimately associated with certain mineral substances. These so-called "salts" of calcium, phosphorus, and iron are very important in nutrition and are indispensable to the proper carrying out of the body-building processes of the child. In the "refining" of sugar these essential mineral elements are removed because they are considered "contaminations." The result is a beautiful, white, glistening, crystalline sugar whose food value has been markedly lowered by the elaborate and expensive "refining" process. The negro boy who sucks a sugar cane on a Cuban plantation or eats grapes in a California vineyard is getting a better food than is the more favored child who receives its sugar in the form of the "cut" or

powdered product. The "old-fashioned" syrups and molasses were also better foods than the more refined modern products.

Is It True That "Heavy Drinkers" Eat Very Little Candy?

It is a matter of common experience among physicians, and others in a position to acquire accurate information on this point, that those persons who use alcohol to excess eat very little candy, and in many instances show an absolute lack of a "sweet tooth." This does not mean that a young lady may try the "candy test" upon her "best fellow" and find out whether or not he uses alcoholic drinks. There are many men who eat candy who will not refuse a cocktail if proper pressure is brought to bear.

In one of their principal functions, namely, the production of heat, the body is unable to successfully differentiate between candy and alcohol. They are both taken rather rapidly into the blood, and carried to various parts of the body, where they are burned (oxidized) with the liberation of heat. Thus, a certain stimulation or feeling of well-being follows the ingestion of alcohol or candy in small comparable quantities. However, when we term beer, wine, and whisky "alcoholic foods" we are guilty of "dietetic camouflage." When candy and alcohol are used to excess, the similarity

in their behavior vanishes, although there are those who tell us that there is such a thing as "a candy jag." During the war Uncle Sam's ban on "booze" stimulated candy consumption, in spite of the plea to conserve sugar in the interest of our Allies.

Will the Eating of Large Amounts of Candy or Sugar Cause Diabetes?

No! Diabetes is a disease in which the body has lost the power of making proper use of sugar, and this substance is, therefore, reduced to the minimum in the diet of persons so afflicted. However, the disease does not ordinarily arise from the eating of sugar, candy, honey, or any other form of "sweetmeat." In certain cases where large quantities of "sweets" have been eaten daily for long periods of time there may apparently be traced some relationship between this sugar consumption and the onset of diabetes.

Are the Coloring Matters Put in Brightly Colored Candies Harmful?

Before the pure food laws went into effect, much cheap and brightly colored candy was offered for sale which was shown to have a distinct poisonous action upon the body. The great bulk of these "pretty candies" were eaten by children, and many cases of its harmful effect are on record. At

the present time it is unlawful to sell candies colored by certain dyes which have been shown to be poisonous. Much colored candy is still sold, but the greater part of this is undoubtedly colored by dyes which have been "certified" as harmless by the United States Department of Agriculture. Even so, however, the stomach is just as well satisfied with confections which are not artificially colored.

Does the Using of Glucose in Place of Part of the Sugar in Making Candy Interfere with the Digestion of the Candy?

No! It is time we abandoned the idea that foods containing glucose are "adulterated." Glucose is a good food, and when taken in proper amount is readily utilized by the human body. It requires no digestion, but is absorbed from the bowel into the circulating blood in the same form in which we eat it. On the other hand, cane sugar, the so-called granulated sugar, must be changed (inverted) into "invert sugar" before the body can use it, and one of the constituents of "invert sugar" is glucose. If eaten in similar amount the stomach is unable to differentiate between glucose and cane sugar. The latter is about two and a half times as sweet as glucose, and for this reason many persons find it more palatable. Outside the body we may change cane sugar into "invert sugar,"

by boiling, or by treatment with an acid or an inverting ferment or enzyme (invertase or sucrase) which is present in yeast. When the housewife boils acid fruits with cane sugar she changes some of the cane sugar to "invert sugar," and lessens the sweetening value of the sugar, since "invert sugar" is not so sweet as is the original cane sugar.

How About Taking a "Hike" on a Bar of Chocolate?

Chocolate is a food of value, being composed principally of sugar and fat. It has pronounced "stimulating" properties and is very useful in the diet of persons undergoing strenuous physical exercise. A half-pound of milk chocolate contains over 1,000 calories of heat, *i.e.*, over one-third the twenty-four-hour requirement of an adult man. The stomach prefers sweet-milk chocolate to chocolate cream candy.

What Is the Difference Between the Digestion of Granulated Sugar and "Old-fashioned" Brown Sugar?

Practically no difference! But the digestion of a sugar does not tell the whole story so far as the needs of the human body are concerned. Granted that the white and brown sugars are equally well digested, brown must "get the call," since it is *a better food.*

As we have mentioned elsewhere (page 190),

the "refining" of a sugar removes mineral substances which are very important, particularly to the growing child. The "old-fashioned" brown sugar is not pretty to look upon and may even be called "impure," but the bodies of our babies welcome it much more enthusiastically than they welcome the "pure" white product.

Is Maple Sugar Handled Well by the Stomach?

Yes! The stomach reacts practically the same to maple sugar as to granulated sugar or glucose. Maple sugar is principally cane sugar (83 per cent.), the characteristic flavor being imparted by other constituents. The "soft" maple sugar is particularly appealing to the youngster for use on bread or hot cakes as a butter substitute.

Which Does the Stomach Prefer, the Chocolate Cream or the Bonbon?

The stomach is neutral! If eaten in proper quantity (one quarter of a pound or less) at proper times (during or after meals) either form of confection is well handled by the normal stomach. The stomach shows a preference for the entire chocolate cream as compared with the interior (cream) portion minus the chocolate. In contradistinction to the inside of a chocolate drop the outside or chocolate portion is particularly acceptable to the stomach.

Is Fresh Candy Digested Easier Than Stale Candy?

We made some tests upon chocolate creams which were eight months old and compared their digestion with the digestion of fresh chocolate creams. We were surprised to find that the stomach did not discriminate in any marked way against the stale product. However, the fresh candy is, of course, much the more palatable and a more acceptable food. The stale candy loses in flavor, sugar crystallizes out and the fat becomes somewhat rancid, but no poisonous substances are ordinarily produced.

How Do Soft "Chewing Candies" Act in the Stomach?

"Chewing candies," such as salt-water taffy and caramels, are well received by the stomach, if taken in reasonable quantity. There is a tendency to eat too freely of a soft candy, and for this reason the "candy craving" of a child may be rather more satisfactorily regulated, and the danger of digestive disturbance lessened, if the hard "sucking candies" are judiciously employed. The "chewing candies" should come second on the roll of approved confections.

Do "Meat-eaters" Crave Candy?

The statement has been made that "pronounced meat-eaters have very little desire for sugar and

bonbons." I do not believe there is any scientific basis for this statement. In my own experience, there are many, at least, who can empty a two-pound box of candy with as great deftness and celerity as they can "put away" a full-sized sirloin steak. In the majority of cases it comes down to a question of *appetite*, a big appetite having a "broad outlook" on life no matter to what point of the compass the dietetic vision may be directed.

Is Chocolate Fudge an Easy Candy to Digest?

The constituents of chocolate fudge, when properly prepared, are all good digestible substances, the only one which might delay digestion being butter. If considerable fat is used in the fudge the material may remain in the stomach about a half-hour longer than would otherwise be the case. The gastric juice, manufactured by the stomach upon the entrance of chocolate fudge, is much stronger than that with which the stomach welcomes chocolate wafers, for example. There are many kinds of fudge, of which *good* fudge, *bad* fudge, and *worse* fudge are but three varieties.

Is Candy Containing Nuts, Such as Peanut Candy, More Difficult to Digest Than Plain Candy?

Somewhat! All nuts are very concentrated foods and are rather slow of digestion, whether eaten alone or in the form of a nut candy.

How Does the Stomach Take Care of Fruit Candies, Such as Glacé Grapes, Strawberries, Dates, etc.?

Fruits are readily digested, whether fresh, dried, or glacé. If the glacé fruit is surrounded by a thick coating of sugar the digestion will be somewhat slower than the digestion of fresh or dried fruit.

Are Toasted Marshmallows Easily Digested?

Yes! The toasted product has a much pleasanter flavor than the original marshmallow, and is much more acceptable to the stomach. The plain marshmallow evokes a gastric juice only about 60 per cent. as strong as does the toasted marshmallow, and causes the stomach nearly 50 per cent. more labor.

Should Children Be Permitted to Eat Licorice?

Licorice, occasionally in small amount, will do no harm. However, the material sucked from a stick of licorice in fifteen minutes will cause the stomach much more trouble than will the material sucked from an ordinary stick of candy during a similar period of time. In other words, the stomach is strongly prejudiced in favor of hard candy as contrasted with stick licorice. The laxative action of licorice is a factor in its favor.

What Is the Difference Between Cane Sugar and Beet Sugar?

There is no difference. One comes from the sugar-cane and the other from the sugar-beet, but they are identical in appearance, taste, food properties, and digestion. Canned goods and jellies have similar keeping qualities no matter which sugar is used.

Does the Pulling of Candy Increase Its Digestibility?

No! Candy in the "raw" state, *e.g.*, molasses taffy, is just as digestible as that which has been refined by pulling. In fact, the flavor of the "raw" material is more attractive to many than is the flavor of the pulled product. However, the pulling process makes a candy which has better chewing properties. Therefore, such a candy "lasts longer." "Candy pulls" are great sport, but the increased value of the product is not at all commensurate with the expenditure of energy.

What Are Satisfactory Candy Substitutes for the Child?

The list is long and includes fruits (either fresh, dried, or glacé), jam, jelly, honey, maple sugar, ice-cream, or plain cookies. Each of these is digestible and in moderate amount may be included in a child's dietary.

Is Popcorn a Good Food?

Yes! It is very similar in composition and food value to other corn products. It is preferable to do your own popping, since the purchase of popped corn at current market rates is not economical. The addition of butter or sugar to the popcorn increases its food value, and, if added in small amount, does not interfere with the proper digestion of the corn.

Is It Well to Drink Water with Candy?

Yes! A drink of water is a good thing at any time, either with or without food. The practice of water drinking after the eating of candy is especially desirable, inasmuch as the water dilutes the candy solution and aids in its digestion.

Should a Child Be Permitted to Eat Candy Between Meals?

No! The proper time for a child to eat candy is after meals. If eaten before meals it "takes the edge off" the appetite and there is a consequent tendency to eat too little of the more substantial foods which the table offers.

Are Home-made Candies Easier to Digest Than "Store" Candies?

Provided both forms of candy are properly made, there is practically no difference in their digestibility.

How Does Highly Flavored Candy—e.g., Peppermint—Influence Digestion?

The stomach reacts more favorably toward plain sugar or a mildly flavored candy than to a strongly flavored candy, such as a strong peppermint "drop."

Is a Candy Which Is Eaten Slowly More Easy to Digest?

Yes! This is due to the fact that we introduce a dilute solution of sugar into the stomach, whereas if we eat the candy rapidly a much more concentrated solution is formed.

Does Candy Overwork the Stomach?

Certain types of very rich candy, when eaten in excessive amounts, may cause considerable gastric distress. It will pay you to be temperate in your candy eating.

CHAPTER XII

THE FOOD VALUE AND DIGESTIBILITY OF FISH AND SEA FOOD

Before war conditions upset Uncle Sam's economic equilibrium he was paying nearly two and a half billions of dollars a year for meat to eat and only about one-thirtieth as much for fish.

Americans have always been slow to appreciate the food value of the fish. Whereas we eat but twenty pounds of fish per year per capita, our friends the Japanese consume about five hundred pounds per person, and among our other "personal friends" Great Britain is lowest, with an annual per capita consumption 500 per cent. greater than our own. However, as a result of the spirited propaganda of the Bureau of Fisheries, and the Food Administration the fish is coming into its own.

The food value and digestibility of fish and sea food are discussed in the following questions.

How Do the Food Values of Fish and Various Meats Compare?

Fish and meat are of service to our bodies because they contain tissue-building and energy-yielding materials. The proteins of these foods serve as builders of muscle, whereas fat is the material which is burned in the body to yield heat.

So far as tissue-building is concerned, the flesh of the fish is almost as satisfactory as that of the sheep, steer, or chicken. Therefore, from this standpoint, "fish, flesh, or fowl" will each give us good service.

When we come to the question of fat content, we find that many fish are low in this important food principle. In fact, it is customary to classify fish as "fat fish" and "lean fish." Thus, salmon contains over 13 per cent. of fat, the eel nearly 19 per cent., and the catfish over 20 per cent., whereas, among the lean fish, we find that the cod, haddock, and flounder contain less than 1 per cent. of fat, and the carp's fat content rises but slightly above this figure.

The "fat fish" compares very favorably in fat content with sirloin steak and leg of mutton, each of which contains 19 per cent. of fat, whereas chicken, with its 2½ per cent. of fat, may be considered as more nearly comparable to the "lean fish."

Certain fish have a fairly high content of both protein and fat. The salmon, eel, lake trout, mackerel, shad, catfish, and butter-fish belong in this class. Thus, a pound of salmon, catfish, or eels will yield as many calories of heat to the body as will a pound of lean beef. It is thus apparent that we may substitute fish for the meat of our diet without dietetic detriment. The strain upon the family budget will also be somewhat lessened, in spite of the fact that the price of fish has been steadily rising since fish was suggested as a meat substitute.

Is a Complete Substitution of Fish for Meat Desirable with the Average Person?

No! A person who has been habitually accustomed to eat meat six days a week and fish only one day should not make a sudden and complete substitution of fish for meat. If such a substitution is made, slight digestive disturbances might result. In order to avoid such disturbances the substitution for the average person should be a gradual one up to a maximum of three or four *meatless days* per week. If necessary, for any reason, we can institute *meatless weeks, months, and even years*, since one can live very comfortably without partaking of meat in any form, as the history of vegetarianism and lacto-vegetarianism will show.

In fact, there are those who contend that the

general reduction in our diet which the war compelled will prove a blessing to those of us who rigidly obeyed the mandate of food conservation. That Americans, as a class, eat too much there can be no doubt, and a lowering of our meat intake alone may well be expected to be followed by an improvement in national health.

Are Shell-fish as High in Food Value as Non-shell-fish?

Shell-fish as a class are lower in food value than are the non-shell-fish. Of the common shell-fish, the shrimp has the highest food value. The shrimp is higher in protein (25 per cent.) than are the meats (10 to 20 per cent.), but its fat content is very low (1 per cent.).

The oyster and clam, although widely used as a food, are, nevertheless, low in food value. The crab and lobster possess more food value than the clam and oyster, but not so much as the shrimp.

The fattest fishes, such as the salmon, catfish, and eel, yield twice as much energy (calories) to the body as do shell-fish. Non-shell-fish, which are somewhat similar in food value to shell-fish, include sea bass, bluefish, cod, flounder, haddock, and perch (yellow). A shell-fish product which possesses an exceptionally fine flavor is the scallop (*Pecten irradians*). The edible portion is the large white muscle which holds the two shells of the bi-

valve together. It is an unfortunate fact that scallops generally cost more than their food value warrants. The mussel is another shell-fish which possesses a similar food value to that of the oyster.

Is It True That Ice-cream or Milk Should Never Be Taken with Crabs, Shrimps, Oysters, or Lobsters? Why?

Very painful digestive disturbances have followed the eating of lobsters, or crabs in particular, along with milk or ice-cream. The writer speaks "feelingly" on this subject, since his name is on the "casualty list." However, the majority of people can take shell-fish and milk preparations without experiencing any discomfort. In fact, some of the most highly prized shell-fish dishes include milk in their preparation.

A considerable number of people *occasionally* have digestive difficulty with the "shell-fish-milk" combination, whereas a certain few find that the eating of such a diet is *universally* associated with painful sensations fully as pronounced as those which accompanied the eating of the green apple of their childhood. The *occasional* "shell-fish pain" is probably due, in some instances at least, to the ingestion of shell-fish which are not fresh or which have become polluted in the course of marketing.

When the digestive difficulty is experienced, irrespective of the season of the year, time of day,

or method by which the shell-fish is cooked, then we must look for a more profound and deep-seated explanation. There is no evidence that poisonous products are produced when shell-fish and milk, or milk products such as ice-cream, cheese, butter, etc., are brought into contact, either inside or outside of the body. When a person is habitually poisoned by a shell-fish-milk diet, it probably represents a well-marked case of idiosyncrasy or "food anaphylaxis," to which reference has been made in previous chapters (see pages 70 and 88).

In the past, certain oystermen have been known to resort to the pleasant pastime of fattening their bivalves in sewer beds. Unfortunately, one unversed in "oysterology" cannot distinguish a "sewer-bed oyster" from its "decent" associate. However, oysters have been shown to contain harmful bacteria such as typhoid fever germs, and several epidemics of typhoid fever have been traced to the eating of raw "sewer-bed oysters." Governmental control makes it practically impossible to market such oysters to-day, and we may, therefore, take the modern oyster either raw, stewed, or fried with no fear of the frisky typhoid bug.

Are the "New" Fish Vouched For by the Bureau of Fisheries Easy of Digestion?

Of those fish recently suggested for wider consumption by the Bureau of Fisheries, we have

studied the bowfin, goosefish, tilefish, carp, whitefish, and whiting. We have found each of these fish to possess good food value, and to be as easy of digestion as the fish in more common use. The grayfish (more commonly called "dogfish"), which the Bureau of Fisheries has been pushing, has also been shown to be a good digestible fish. It may be bought canned. Its high content of ammonium salts makes it less appetizing to some people than the ordinary food fish.

Is Fish Roe a Digestible Food?

Yes! The roe of the shad, herring, and sturgeon is most frequently used. The roe of the sturgeon, preserved in salt, is called caviar, and while it has much greater food value than the roe of shad or herring, it is so expensive that its cost is out of all proportion to its food value. In common with other fish roe, caviar is satisfactorily digested when not eaten in too large quantity. The roe of the carp is another good food which is but little appreciated. Carp roe has been made into "caviar," but has not become a commercial product. The carp "caviar" is pink or red, whereas the sturgeon caviar is black or grayish-black.

Is It True That Fish Is a "Brain Food"?

No! This is a popular impression, but has no basis in fact. It is true that the brain contains

phosphorus and that this element is also present in fish and other foods, but brilliancy of intellect is not fostered by the inclusion of fish in the diet. In fact, there is no set relation between diet and mental activity. A dietary regulation which will enable one person to secure maximum mental efficiency may be absolutely unsuited for all other persons.

Is the Flesh of Fish as Digestible as Meat?

Yes! The average normal stomach, which has no difficulty in digesting meats, will also have no trouble in handling fish. Of the common foods, such as eggs, breads, cereals, milk, meat, fish, and vegetables, the stomach finds it necessary to give more time to the digestion of meat and fish than to the digestion of the other classes. Roast beef, haddock, halibut, and crab are greeted in similar fashion by the normal stomach and retained for similar periods of time.

Is There Any Difference in the Digestion of Raw, Stewed, and Fried Oysters and Clams?

Practically none! The stomach often shows a preference for oyster stew or clam stew, but that is due to the other ingredients which are present (milk, butter, etc.) rather than to the stewed oysters or stewed clams.

Is Terrapin Worth the Price?

No! Terrapin has about the same food value as bass, halibut, or salted codfish, and costs many times more. Since the stomach is not concerned with the family budget, it finds terrapin much to its liking, and digests it readily. The green turtle is also good food. Its flesh possesses a food value about the same as that of the lobster and possesses a similar digestibility. Even the plebeian "mud" turtle may be used as food.

Does the Flesh of the Whale, Shark, Seal, and Alligator Possess Much Food Value?

Yes! The flesh of the whale is used more widely than either of the others. The whale is a mammal, and its flesh, therefore, is not "fish," but "meat." It is a red meat, resembling beef and is about as digestible. Whale meat is eaten in large quantities in Japan, and it may be obtained in our own markets in the canned form. Many people object to eating shark because of its disreputable and unsanitary habits. It is safe to say, however, that the food of the shark is as hygienic, and its habitat as sanitary, as that of the pig, and yet most people consider pork an important food. The flesh of the seal is just making its appearance on the market. Alligator meat has not been sold commercially as yet, but there is no

reason for considering it other than a good beef substitute.

Are Salted and Smoked Fish as Digestible as Fresh Fish?

The stomach handles these three equally satisfactorily. The bowel also reacts about the same to smoked fish and fresh fish, but is sometimes a little less cordial to the salted variety. The difference is not great, and we must, therefore, consider salted fish as good wholesome food. For children, salted foods of any kind are not as desirable as those less highly seasoned. A fish which is very useful in the smoked condition is the bowfin, whose food value was recently emphasized by the Bureau of Fisheries. We have found that the stomach digests it as easily as smoked herring.

Does the Stomach Care for Sardines?

Yes! The sardine is a readily digestible fish, and when eaten with oil affords a dish of higher food value than any other fish. When eaten with mustard the food value is not so great, and the digestion is slightly retarded, as was also found to be true with meats. The real sardine comes from France, Spain, and Italy. A "sardine," consisting of a small herring having its habitat along the Maine coast, has been offered for sale in our markets.

Is Frozen Fish Easier or Harder to Digest Than Fresh Fish?

A fish may remain frozen for twenty-seven months and not undergo any marked change in food value or digestibility. This is in line with the fact that cold-storage chicken is as digestible as the fresh fowl, and the further fact that "frozen" eggs may be used in cooking without lowering the digestibility of the dish so prepared. It is an interesting fact, vouched for by the Bureau of Fisheries, that certain fish may be frozen solid, in ice, for months, and live. This occurs habitually in Siberian rivers which freeze solid during the winter. The fish thaw out in the spring, and thereafter act no differently from similar fish which had never been frozen. In fact, living fish have been transported long distances for commercial purposes, frozen in ice blocks. These things sound a little "fishy," but are all true. We see, therefore, that a frozen fish is not necessarily a dead one.

Are the Coarse Fish, as Cod, Salmon, Halibut, etc., as Easily Digested as the Smaller Fish, Perch, Bass, Brook Trout, etc.?

Yes! The texture of the fish has but little influence upon its digestion. This finding is in line with the observations that meat when "bolted," *i.e.*, swallowed in large pieces, is digested about as

well as when thoroughly chewed, and that "tough" steaks are digested as readily as soft and tender meats.

How About the Digestibility of Canned Fish as Contrasted with Fresh Fish?

This point was studied in connection with the salmon, and it was found that the canned fish was taken care of by the stomach just as easily as was the fresh fish. So far as food value is concerned the canned salmon is only slightly less valuable than the fresh.

Is Lobster More Likely to Cause "Indigestion" Than Any Other Shell-fish?

No! The crab is a very lively competitor for the lobster in this connection, and it is impossible to decide which is entitled to the "blue ribbon," since both are such able performers.

Is the Chief Food Value of Oysters and Clams Provided by the Materials They Are Cooked in —i.e., Milk in Stews or Fat in Frying?

The food value of all shell-fish is low and if we list them according to their food value the universally eaten oyster and clam must come at the bottom. The food value of shell-fish dishes is much increased by the addition of milk or butter in their preparation.

What Method of Preparation Makes So-called Shell-fish Most Easily Digested?

The method of preparation has but little influence upon the ultimate digestion of shell-fish. The stomach devotes about the same amount of time to it irrespective of the form in which it is eaten.

Does the Addition of Lemon or Tomato Sauce to Fish Influence Their Digestibility?

For some persons the addition of lemon or tomato sauce makes the fish more palatable, but the substances do not render the fish any more digestible.

CHAPTER XIII

IS IT GOOD BECAUSE IT LOOKS GOOD? OR, THE PSYCHIC FACTORS IN DIGESTION

IT is common knowledge that the "mouth waters" when one contemplates a particularly appetizing dish. It is *scientific* knowledge that the stomach also "waters" under similar conditions. In other words, there is an increased outpouring, not only of saliva, but also of gastric juice. On the other hand, under certain conditions there may be a *decreased* flow of these juices. Thus, the mouth of the man unaccustomed to public speaking is often dry when he faces a large audience for the first time. The part played by the emotions in the actual digestion of our food and the pronounced way in which the stomach is influenced by these "psychic" matters is indicated in the following discussions:

Do the "Emotions" Have an Influence upon Digestion?

Yes! Pleasurable emotions form an impetus to the flow of digestive juices, whereas anger, fear,

worry, anxiety, grief, and remorse have a pronounced retarding influence. The movements of the stomach and intestine, which accompany normal digestive processes, are also inhibited by the latter class of emotions and facilitated by those of a pleasurable type.

The pleasurable emotions are less efficient than those which are unpleasurable. Thus, a girl in school or college who is trying to pass a difficult examination may be so influenced by worry and anxiety, with an admixture of fear, and perhaps a little anger, that her stomach will show a decrease in the secretion of gastric juice and in muscular movements such that the food may take twice as long as normal to digest (see page 101). If the girl is unfortunate enough to have an abnormal stomach, the chances are also pretty good that she will have a much more unpleasant time during and after the examination than will her girl friend of robust digestion. It is, moreover, frequently observed by physicians that patients with "stomach pains" are liable to have them in an aggravated form when they worry or become angry. All such observations as these make it very clear that it is dietetically inappropriate to have a "grouch" at meal-time.

Furthermore, the parent who insists, with a show of temper, that the refractory offspring eat a food which the refractory one despises is interfer-

ing not alone with his own digestion and that of the child, but with the digestion of all members of the family present. Of course, some individuals are more "temperamental" than others, and we would not expect the emotions to have as pronounced an influence upon the digestion processes of a stolid, phlegmatic individual as they would have upon the digestion processes of a "nervous" adult or a "spoiled" juvenile. However, the influence of the emotions upon digestion is a very real one and has been demonstrated beyond question.

What Is the Psychic Value of Eating at Home Compared with Eating in a Restaurant?

If one has been reared upon "good cooking" there is nothing that can take the place of the dishes that mother or wife prepares. We are, or should be, happiest in our own family circle. The feelings of contentment and pleasure all aid in the proper digestion of our food. If "wifey's" cooking experience is all to be accumulated after the honeymoon period, it is safe to say that "hubby" is in for a few bad sessions at meal-time and will undoubtedly get better food value, and more psychic stimulus, at any restaurant than the products of wifey's murderous onslaughts upon good recipes will yield.

There is no excuse in these days for any woman being unable to prepare food decently, inasmuch as great emphasis is now very properly placed upon

household science matters in all first-class schools. In these days the restaurant eater is subjected to a very real "psychic" influence in the rapidly rising price scale on the menu.

We often hear the phrase "Home cooking always tastes so good." Anything will taste good to a person who through long absence hungers for a sight of loved faces in the old home. Little thought is given by such a person to the flavor of the food "mother" prepares. The mere fact that it is "mother" is enough.

Does the Aroma of Bouillon Placed at Each Cover of an Attractively Set Table Start the Flow of the Digestive Juices?

Yes! In fact, it is not necessary that one shall actually note the aroma in order to interest the stomach. Past experience has made us familiar with the aroma of bouillon and the stomach responds *at sight.* Anything which temporarily nullifies the sense of smell does not necessarily nullify the digestive action of the stomach, although it may interfere considerably with the psychic stimulation of the stomach. A bad cold in the head, for example, has such an effect.

What Is the Effect of Eating on a Moving Train?

The mere fact of putting food into your stomach while you are being whirled through space at a

rapid rate has no actual bearing on the digestion of that food. The *reason for your presence* upon the moving train, may, however, be an important factor in altering the course of your digestion. Are you on your honeymoon, or is it your misfortune to be on your way to begin a "life term" in a Federal prison? If you are "honeymooning" the digestive juices ought to flow in a very exuberant manner, whereas the sorrow attendant upon the other contingency certainly would inhibit the digestive processes.

Is It True That "What Man Likes Best He Digests Best"?

Not always! There are a great many men and women who are "passionately fond" of certain foods which they cannot eat because these foods "do not agree" with them. In short, these foods are unsuited to the needs of the persons in question. The following experiment also shows that man does not always digest best those foods which he most prefers. Two men were fed old preserved meat, unappetizing in appearance, foul of odor and nauseating to taste. In other words, the meat was devoid of any attributes which appealed to sight, taste, or smell. These men were literally forced to "poke" the stuff down the throat in order that it might reach the stomach. This was sufficient proof that there was a strenuous protest from the esthetic

sense of the men who were unanimous in pronouncing the meat "unfit to eat." But the human body, apart from the esthetic sense, did not condemn the unsavory dish. In fact, it was found that the men derived about as much benefit from it as from a similar quantity of fresh meat. These facts would lend color to the belief that certain foods are not necessarily bad because they "look bad," and fail to substantiate the theory that unpalatable food is not properly utilized by the human body. This observation does not mean that it would be advisable to make a practice of eating nauseating foods. The entire digestive system might ultimately rebel against such a diet, and grave digestive troubles might result. It is fortunate for certain war prisoners that diets of this character are not entirely without nutritional value.

What Is the Effect on Digestion of Having Good and Bad Music When Eating?

That depends on whether you are a highly trained musician or are absolutely devoid of "musical sense." To hear a musical masterpiece "murdered" will certainly interfere with the flow of the digestive secretions of a trained musician, whereas the proper rendition of the same selection will have an opposite influence.

Is the Digestion of Food Influenced by the Surroundings in Which It Is Eaten or the Manner in Which It Is Served?

Not necessarily! In one of our experiments a normal man was fed a selected diet, tastily prepared and served. The actual digestion was determined by proper tests. On subsequent days the same articles of food were mixed together in an unsightly "mess" and served from dirty dishes in unsanitary surroundings. Even the air of the room was saturated with foul, ill-smelling odors. In short, the concoction which was fed had the same food value as before, but was made as unattractive and unappetizing as possible. The stomach did not greet the "mess" as enthusiastically as it did the esthetically served food. But the bowel and the human body as a whole was not to be led astray by appearances.

"Food value" is what the body demands irrespective of the form in which it is offered. Therefore, our final tests demonstrated that the body derived about as much benefit from the unattractive, unappetizing "mess" as from the esthetically served food. The man certainly had no "enjoyment" in the eating of the "mess" in the presence of foul-smelling odors, and yet there are those who say that "food eaten without enjoyment lies like lead in the stomach and does more harm than good."

The individual who is forced to eat at a restaurant table surrounded by dirty dishes and served by a waitress in unsanitary attire may gain solace from the thought that the food value of a diet is gauged, not by the esthetic elements which enter into the preparation and service of the food, but rather by the nutritive substances present. In other words, we cannot accept the statement of a food expert who says, "A dish that looks tempting is far more digestible than one which is just as well cooked but served in a sloppy manner."

Our tests do show very clearly, however, that a poorly prepared and carelessly set table, minus a table-cloth and littered with greasy, dirty dishes, fails to evoke a normal response from a normal stomach even though the food may possess proper food value. In other words, the stomach *enters a vigorous protest* and refuses to do its complete digestive duty. But even if the stomach does "strike," that fact does not tie up the entire line of digestive transportation. Our tests show that the intestine comes to the aid of the body and does its own work, and that of the stomach as well, in the emergency. Thus the actual loss to the body is but slight at the most. Some stomachs seem to be able to handle food pretty satisfactorily no matter how dirty it looks. It depends on how the person in question was "brought up" and is also influenced

by the temperament of the individual, *i.e.*, whether neurotic or phlegmatic.

Is "Flavor" the Most Important Attribute of a Food?

Not at all! However, the stomach is very susceptible to the seductive influence of "flavor" and begins to set forth the "best (fluids) in the house" as soon as food possessing a pleasant flavor is masticated. In other words, there is a free flow of gastric juice as soon as we chew foods which possess an attractive taste. This juice is called "appetite juice" and the extent to which the stomach manufactures it depends upon the extent to which the particular food appeals to us. But the mere fact that the stomach makes a big "fuss" over the material in question does not necessarily mean that it is a good food. On the contrary, it may be perfectly worthless as a food. Thus, we may take a piece of linoleum from the kitchen floor or a portion of leather from the boot of the garbage-man and saturate them with attractive food flavors which are practically devoid of food value and thus make a product which will cause a copious outpouring of gastric juice when chewed.

We cater to the esthetic sense when we seek "well-flavored" foods. The tasty dish appeals to our palate and we are in a much more exalted mental state than when partaking of an insipid, underseasoned dish. But the human body as a whole

is not bothered by such small matters. The finest tenderloin steak fares no better in the end than the less tasty meat purchased for less money. The stomach puts itself to a whole lot of trouble to give the tasty food a good reception, but the bowel sees to it that the final disposition of the tasteless food is just as satisfactory as is that of the highly flavored. The human body would in no way suffer were we to introduce a *flavorless day* into our menu. Flavor "tickles the palate" and adds temporarily to one's feeling of well-being. In the final analysis, however, the value of a food rests not upon flavor or taste, but upon actual food value. If the calories, vitamines, and other recognized nutritional necessaries are present, the question of flavor is not at all paramount. Flavor does, however, play an important part in "coaxing" the appetites of children, invalids, and all others of feeble appetite.

Not only the stomach, but the mind of the human animal is many times swayed by flavor considerations in the selection of a diet even to the point of sacrificing food value. We many times eat what "tastes good" with no thought of its actual use to the body. It will be a great aid to the restaurant eater when all such places state the food value of each dish as well as the price.

Flavor is an important factor in the so-called "psychology of diet." We eat certain foods pre-

pared in certain ways because we like them better than other foods prepared in other ways. In short, the particular flavor appeals to us. It is the eating of foods with unfamiliar flavors that makes it difficult for some persons to adapt themselves to the use of war "substitutes" for various standard food preparations of their dietary. However, if we were conscientious in the use of such substitutes, as our Food Administration suggested, we are the gainers. We not only aided in winning the war, but showed ourselves that we could live fully as satisfactorily without some of the more expensive foods. One lesson we learned which will never be "unlearned." This is that white bread made from highly milled wheat flour *has far less flavor* than whole-wheat bread, rye bread, or any one of the good "war breads." This same white bread will have a hard time to take its old place in the affections of the American stomach.

Which Has the Most Pronounced Effect upon the "Psychic Secretion" of Gastric Juice, Sight, Smell, or Taste of Food?

Sight! In studying these points we clamped the noses of normal men and after permitting them to *look* at nice things to eat for a time we measured and analyzed the gastric juice which was present in the stomach. These tests gave us the effect of *sight* alone. In other tests we blindfolded the men

and permitted them to inhale the aroma of frying beefsteak. This gave us the effect of *smell.* In the third type of test the noses were clamped while the men chewed cooked meat. The influence of *taste* alone was thus determined. When our results were compared it was found that the stomach was influenced rather more by the mere *sight* of appetizing food than by the *smell* of food which they *could not see* or by the *taste* of food which they *could not smell.* Of course, in the ordinary chewing of food the flavor which we note is due to the combined influence of taste and smell. This combined effect exerts a very important influence upon the flow of gastric juice. If the sense of smell is eliminated the flavor is markedly lessened. This point is appreciated by the parent who holds the child's nose when disagreeable medicine is to be given the youngster. Each one of us will get much more pleasure out of the mastication of the food we eat if we will keep our mouth shut and exhale through the nose.

Is the Overeating on the Dining-car or Steamship on Long Journeys Due to the Psychic Effect of Attractive Service or Lack of Something Else to Do?

In the course of a three-thousand-mile transcontinental railroad trip with nothing to do but eat, sleep, and make one's self agreeable there is a defi-

nite tendency to overdo the eating part of the program. I do not think that the "attractive service" is an important factor, for a very attractive service at the start of the journey is liable to "lose caste" before the trip ends.

Unfortunately, overeating is not confined to such journeys as the above. Too many people "live to eat"; too few "eat to live." There is a very well-developed tendency inbred in American men and women to overeat if given half a chance. Many digestive ills undoubtedly have their origin in this practice. If through necessity or for patriotic reasons we were induced to live upon a lower "food level" the great World War did not result in peace "without annexations and indemnities." The more rational diet enabled each of us to "annex" a more healthy body and the "indemnity" will be represented by an increase in the savings fund.

What Effect on the Digestion Does "Eating Against Time" Have?

That depends upon the kind of food we eat! If we confine ourselves to soft food which needs little or no mastication the rapidity with which it is introduced into the stomach does not materially influence its digestion provided our stomach is normal. In fact, we may "bolt" certain meats in relatively large pieces, and get about as much good

out of them as though we chewed them until there was nothing left to chew, that is, "fletcherized" them (see page 106). I have repeatedly seen luncheons of hot soup and ice-cream taken in five-minute intervals with no subsequent discomfort. For many articles of diet it is unquestionably *only necessary to get them into the stomach*, irrespective of the physical characteristics of the food or the rapidity of its entrance. In the case of foods such as certain vegetables which contain considerable cellulose (woody material) thorough mastication is a requisite. It is far from true, as some would have us believe, that rapid eating "makes us feel like swearing off eating for all time."

What Is the Effect of Reading While Eating?

The simple act of reading has no effect upon digestion processes. After the food reaches the stomach the digestion procedure is entirely involuntary. Therefore, the stomach goes about its business whether we are reading, talking, or listening to the conversation of others. In case you read of the marriage of your "best fellow," the murder of your husband, or that your rich uncle failed to mention you in his will, your digestion may be influenced. Here we have the "emotional factor" once more, and either remorse, sorrow, or anger, as the case may be, will interfere with the digestion of your food.

In the case of irritable or morose individuals who

are usually not quite normal, newspaper reading may have a quieting effect in tending to make them forget their trouble, and the ordinary inhibitory effect of these influences may be partly overcome.

Does Eating in the Open Air, for Instance at a Picnic, Affect the Digestibility of the Food?

To the average individual a picnic means a "good time." Cares are forgotten and the very atmosphere is surcharged with freedom and enjoyment. In other words, the "picnicker" and his stomach are happy, and a happy stomach is in prime condition to take care of all the food that comes its way. This is simply another instance of the influence of mental attitude upon digestion. A person with a "holiday appetite" generally has small need of the stomach specialist.

Is the Stomach Interested in the Mere "Sound" of Food Cooking on the Kitchen Range?

It certainly is! It is not necessary to *see*, *smell*, or *taste* food in order to interest one's stomach. If we blindfold a man and put a clothes-pin on his nose and lead him into the auditory vicinity of a frying egg or a broiling steak, his stomach will at once prepare for the reception of egg or steak, as

the case may be, by initiating a rapid flow of gastric juice.

What Is the Difference in the Effect upon the Digestive Juices of a Daintily Served Salad or Dessert and a Large Service of the Same Food?

The effect upon the digestive juices is very similar in the two cases. It would, however, take the stomach longer to do its duty by the larger portion of food.

What Is the "Psychic Effect" of Eating a Meal Which You Have Prepared Yourself?

During the preparation of a meal the housewife is continually seeing, smelling, tasting, and even hearing the food. Each of these factors "stimulates" the stomach, and there is therefore a more or less continuous flow of juice from the stomach cells. The act of preparing a meal may therefore "take the edge off" one's appetite. In other words, if we have a series of psychic stimuli the final member of the series will have less effect than the first. There is a great individual variation here, however, since some housewives "can't bear to eat" their own cooking, whereas the appetite of others is not appreciably lessened by the fact that the food was cooked by them.

What Is the Effect on Digestion of Eating When One Is Really Hungry, or Eating Just Because It Is Time to Eat?

The stomach greets food much more enthusiastically when one is hungry. However, the body gets about as much good out of the food in the long run, if eaten without appetite, provided the digestive organs of the particular person are normal.

Do the Digestive Juices Actually Begin to Flow, upon Seeing an Attractively Set Table, Graced with Flowers, Without Any Food on It?

Yes! Although no food is visible the stomach is accustomed to associate such surroundings with things to eat. Believing very thoroughly in the principle of "preparedness" it does not wait until the food is actually in contact with its walls before it sets the machinery in motion. The mere possibility of something to eat is sufficient impetus to cause the stomach to start the manufacture of gastric juice and thus be in position to care properly for the food if it comes.

The sight of food upon the table may cause a more rapid flow of digestive juice provided the food is such as to excite the appetite of the individual in question. The mere *thought* of a juicy tenderloin steak will probably cause many stomachs to "get busy" sooner than the actual *sight* of food,

of which the individual is not particularly keen to partake.

If it is meal-time, the mere sight of a paper chicken, a wax apple, or artificial foods of other kinds may fool some stomachs into manufacturing gastric juice. There is great variation in the response of normal stomachs, however, to such gastronomic "camouflage."

What Is the Influence of Fear or Rage upon Digestion in the Stomach?

The influence of these so-called "fighting emotions" is very great. The stomach appears to be completely paralyzed for the time being both with regard to movement and secretion of digestive fluid. This is most clearly shown with animals, such as the cat, which are readily excited to fear or anger. The movements of the stomach, as shown by the X-ray, immediately cease under these conditions. Pain has the same effect. Human beings are not so susceptible to study when under the influence of violent emotions, but it is well known that gastric nausea and greatly delayed digestion may be brought about by pain, anger, or anxiety. It is good policy to eat sparingly under these conditions until the stomach resumes its normal power and functions.

THE END

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